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HEDGES (FLORENCE). **Bean bacterial wilt.**—*Leafl. U.S. Dep. Agric.* 174, 5 pp., 7 figs., 1939.

Bacterial wilt (*Bacterium flaccumfaciens*) of beans [*Phaseolus vulgaris: R.A.M.*, xv, p. 463; xvii, pp. 799, 810] is stated in this popular account to have been reported from Maryland, Michigan, Montana, North and South Dakota, Oregon, Wyoming, and West Virginia, as well as from Canada, France, Germany, Belgium, Bulgaria, and Australia. Infected seed is the sole known agent of dissemination of the disease, the control of which should be based on stringent selection of sound material for sowing. Fields should be examined both early and late during the growing season, and only those with a minimum of disease used as sources of seed supply. The risk of transmission through the seed may be still further reduced by careful hand-picking of the seed, excellent results from which have been obtained for several years past by a progressive Michigan firm.

TOMPKINS (C. M.), ARK (P. A.), TUCKER (C. M.), & MIDDLETON (J. T.). **Soft rot of Pumpkin and Watermelon fruits caused by Pythium ultimum.**—*J. agric. Res.*, lviii, 6, pp. 461–475, 3 figs., 1939.

*Pythium ultimum* was found to be associated with a soft rot of Zucchini and Mammoth Summer Crookneck pumpkin (*Cucurbita pepo* var. *condensa*) and Klondyke watermelon fruits in California. Fruits of any size and age become infected when in contact with wet soil, and develop soft, sunken, water-soaked lesions, which grow rapidly and cause the collapse of the underlying tissue. In advanced stages the lesions are frequently covered with closely adpressed, white mycelium. The fruits may be completely rotted six to ten days after the appearance of the first symptoms of infection, and such fruits break open on handling. The disease is favoured by cool weather. The causal fungus was readily obtained in culture; some of the isolates did not produce oospores (as a result, it is believed, of the failure of the organism to produce antheridia) but developed, instead, reproductive bodies resembling oogonia. The relation of temperature to the growth of the mycelium was the same in all cucurbit isolates and in those from lucerne, tobacco, spinach, and an unknown host, the optimum being 25° to 28°, the minimum 4°, and the maximum 40° C. All these isolates caused damping-off of pumpkin, watermelon, and tomato seedlings during the pre-emergence and small-seedling stages of growth. Inoculation of uninjured pumpkin fruits in the laboratory was successful but

in watermelons the infection occurred only after wounding. Infection was also obtained in unwounded fruits of green and ripe tomato, bean (*Phaseolus vulgaris*), eggplant, and field pumpkin (*C. pepo*), but wounding was necessary for the infection of the fruits of the apple, bell pepper (*Capsicum annuum*), various cucurbits, lemon, and orange, the roots of turnip, rutabaga, carrot, and parsnip, potato tubers, onion bulbs, and sweet potatoes.

Borzini (G.). **Una particolare malattia della Vite.** [An unusual Vine disease.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 3, pp. 342–359, 9 figs., 1 graph, 1938 (issued 1939).

In July, 1937, vines in Tripoli developed a condition characterized by the presence of 30 to 40 round or irregular spots, 2 to 3 mm. in diameter, on both leaf surfaces. These spots showed a dried-up central part bearing dark tufts of conidiophores of a species of *Alternaria* and had a blackish rim.

In inoculation experiments in Rome by spraying vines with a suspension of the spores of the fungus, typical spotting developed after two days. The simple, brown-olivaceous, sparsely septate conidiophores measured 80 to 110 (average 87·4) by 2·8 to 3·4 (3·15) $\mu$ and were rounded at the extremities. The ovoid, elongated, brown-olivaceous conidia measured 9·4 to 34·5 (average 20·65) $\mu$—excluding the beak (2·28 to 11·5 (2·48) $\mu$ long) shown by about 50 per cent. of them—by 5·1 to 11·5 (8·5) $\mu$. They showed 1 to 4 (average 2·29 septa), about 30 per cent. having oblique or longitudinal septa, and were borne in single chains (occasionally two chains to a conidiophore) of one to five.

The fungus differs distinctly from *A. vitis*, *A. viticola*, *Macrosporium velutinum*, and *M. vitis*, previously recorded on vine, but is close to *A. tenuis*; a more precise identification, however, is not possible until the fungi in this group have been studied in greater detail.

Du Plessis (S. J.). **Bacterial blight in Vines.**—*Fmg S. Afr.*, xiv, 155, pp. 55–59, 4 figs., 1939.

Bacterial blight of vines, originally reported by Ravaz from the Île d'Oléron, off the west coast of France [and attributed to *Bacillus vitivorus*: *R.A.M.*, xvi, p. 229], was first observed in South Africa on the Canaan variety in 1936. It causes the formation of cracks on one or both sides of the young shoots and a dark blackish-brown discoloration of the surrounding tissues, sometimes spreading to the leaves, and also involving the bunches. Primary infection of the foliage results in the development of numerous dark brown spots, usually surrounded by a pale yellow border; in severe cases the sound tissues turn ruddy brown and impart a characteristic flame-like appearance to the vines. Later in the season the spots on the shoots change to a tawny colour and the fissures widen, sometimes exposing the pith, while during the autumn black dots, the fruit bodies of saprophytic fungi, are produced on the tawny-white lesions. The causal organism appears to overwinter in the vines, infecting the new shoots through abrasions and the leaves through the undamaged surface. The disease is spread by the use of infected knives, as well as by means of blighted scions. The most susceptible varieties are Canaan, Santa Currant, and Sultana, while

Raisin Blanc, Barbarossa, Riesling, and others have shown some degree of resistance. Full directions are given for the control of the disease by stringent sanitary measures supplemented by the application of verderame, copper sulphate, or Bordeaux mixture immediately after the topping of the vineyard.

GRAČANIN (M.). **Kloroza Vinove Loze na otoku Visu.** [Chlorosis of Vine on the island of Vis.]—*Ann. Trav. agric. sci., Belgrade*, v, 13, pp. 3–14, 5 figs., 1938. [German summary. Received May, 1939.]

On the island of Vis, Yugoslavia, vines growing on soils rich in iron were found to suffer from a typical iron deficiency chlorosis [*R.A.M.*, xvii, p. 792]. Investigations showed that chlorosis developed on soils containing much calcium carbonate, particularly in a finely dispersed form, but not on those containing small amounts. Since the assimilation of iron by the roots is arrested by the presence of calcium carbonate in the soil, spraying the leaves with a 0·2 per cent. solution of iron sulphate, applied preferably on cloudy days or in the evening, is recommended for control, as well as manuring with stable manure and with acid fertilizers, such as ammonium sulphate, in order to render iron available. Sites for new vineyards should be examined with reference to the calcium carbonate content of the soil.

VIDAL (J. L.). **Rôle de la transpiration et de l'anhydride carbonique dans l'étiologie de la chlorose calcaire.** [The part played by transpiration and carbon dioxide in the etiology of lime-induced chlorosis.]—*C. R. Acad. Sci., Paris*, ccviii, 1, pp. 47–49, 1939.

Continuing his studies on lime-induced chlorosis of the vine [*R.A.M.*, xvii, p. 291 and preceding abstract] the author gives a brief account of experiments, the results of which showed that intense transpiration is an important factor in the development of the disease, as well as the presence in the soil of carbon dioxide; the effect of the latter is to facilitate the solution of calcium carbonate, which in its turn renders insoluble the iron present in the soil. [An account of this work is also given in *Rev. Vitic., Paris*, xc, 2334, pp. 239–241, 1939.]

PADWICK (G. W.). **Report of the Imperial Mycologist.**—*Sci. Rep. agric. Res. Inst., New Delhi, 1937–38*, pp. 105–112, 1939.

This report on plant disease work in India in 1937–8 [cf. *R.A.M.*, xvi, p. 515] contains the following items of interest, apart from those already noticed from other sources. Two years' freedom from wheat considerably reduced soil infection by *Tilletia indica* [ibid., xvii, p. 21]. Plots given excess irrigation developed more infection than others (1·5 and up to 0·5 per cent. in two plots, as against no infection, on P. 165 wheat), confirming the view that moisture plays an important part in the incidence of the disease.

When non-viruliferous white flies [?*Bemisia gossypiperda*] were fed on juice from a leaf curl tobacco plant and placed on about 110 tobacco seedlings raised in an insect-proof cage, two of the plants developed distinct symptoms of a mixed type of leaf curl, and five slight vein-clearing [ibid., xvii, p. 75].

In periodical isolations from wilted gram [*Cicer arietinum*] plants a number of isolates of *Fusarium* [ibid., xvi, p. 151] were obtained, one type being predominant in all. All the types were grown in flasks in a sterilized mixture of dry soil, maize meal, and water, and after three weeks the mixture was applied to a sterilized soil in layers above and below gram seed. In some cases the plants grew as well as the uninoculated controls, in others the seed failed to germinate, while in the case of the type most generally isolated all the inoculated plants wilted and died before they were six weeks old. The original fungus was invariably isolated from the dead plants.

The chief cause of a leaf spotting of *Hevea* rubber in the Mundakayam Valley was determined as *Oidium heveae*.

Further investigations into apple infection by *Rhizopus arrhizus* [ibid., xvii, p. 47, 796] demonstrated that slight decay occurred even at 15° C.; at temperatures of 30° or more the destructive effect on the fruit was well marked. In culture, the best growth occurred at $P_H$ 4·1 to 4·4.

The reduction in yield caused by mosaic in the thick sugar-cane variety Surkha Saharanpuri amounted to 18·8 per cent. [cf. ibid., xvi, p. 232]. Recovery from mosaic in Co. 313 canes, reported from Pusa, was not observed at Shahjahanpur. When mosaic-affected Co. 313 material from Pusa and Shahjahanpur was tested for recovery at Pusa, Delhi, and Karnal, the former was found to show 15 to 20 per cent. recovery, whereas the latter showed none. This result supports the view that the virus strain affecting Co. 313 at Shahjahanpur is different from that attacking the same variety at Pusa. Inoculations with juice from the leaves of recovered plants of Co. 213, 313, 223, 299, and 419 canes gave no infection during the year, indicating that the recovery in question is real and not the result of masking.

Dilution tests (using maize as test plants) with leaf juice from mosaic M–16, Surkha Saharanpuri, Co. 213, and Co. 313 canes demonstrated that the juices of M–16 and Surkha Saharanpuri resisted dilution better than that of Co. 313, which in turn withstood it better than that of Co. 213. Mosaic juices from several varieties were centrifuged for half an hour at 3,000 r.p.m. with no appreciable reduction of virulence in the supernatant liquid.

A careful investigation was made of the 'cyclostage' organisms [ibid., xv, p. 315] reported to have been isolated from mosaic canes, but all attempts to repeat the work on the filterability of these bodies through an $L_3$ Chamberland filter candle failed. It was then ascertained that different methods of testing the candles result in the selection of different grades, and this may account for the different results obtained at various times with regard to filterability of organisms.

Considerable damage to sugar-cane foliage, particularly on thick varieties, was caused at Jorhat (Assam) Farm by *Cercospora kopkei* [ibid., xv, p. 346], not previously reported from India, though found in Burma.

Cultures of the fungus commonly known as *Cephalosporium sacchari* [ibid., xvi, p. 774] were identified at Baarn as *Fusarium moniliforme* var. *subglutinans* (= *Gibberella fujikuroi*) [var. *subglutinans*].

The leaves, twigs, and fruits of chilli plants [*Capsicum annuum*] near

Delhi were observed by Mitra and K. M. Dutt to show greyish or greyish-brown, oval, roundish or irregular spots with concentric rings, produced by an *Alternaria*. The pathogenicity of the fungus was established.

Mango twigs from Bengal were infected by *Dimerosporium mangiferum*. Inside, the wood was ash-grey and contained a black mycelium. On incubation in a moist chamber numerous dark pycnidia appeared on the tissue, with dark, bicellular, striate spores resembling those of *Diplodia natalensis*.

In the course of an examination of species of *Fusarium* on pigeon pea (*Cajanus cajan*), sann-hemp (*Crotalaria juncea*), cotton, *Cicer arietinum*, and other plants, Mehta and the author isolated from wilted pigeon peas several distinct species, one of which appeared to differ from *F. udum* [ibid., xvii, p. 652] and to produce severe wilting but no foot rot. The identity of this fungus is being established.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, 1, 3, pp. 157–61, 4 figs., 1939.

*Zinnia* plantings are reported to have suffered serious losses in various parts of New South Wales from a wilt and root rot disease, for which *Rhizoctonia* [*Corticium*] *solani* was mainly responsible. The hot, dry season is believed to have predisposed the plants to infection. Serious outbreaks occurred on land not previously cropped for eight to ten years. Formalin treatment of the soil in seed-beds and of utensils is recommended for the control of the disease.

All the locally grown commercial varieties of peas are stated to be suceptible in a varying degree to bacterial blight (*Bacterium* [*Pseudomonas*] *pisi*) [*R.A.M.*, xviii, p. 217]. Control measures should include the use of clean seed (although it is not easy to recognize it as such by the external appearance) and the adoption of plant sanitation methods, such as the destruction by burning of diseased plants. Seed disinfection is of limited value, as the disease is carried both inside and outside the seed coat.

**Plant Diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, 1, 4, pp. 199–203, 6 figs., 1939.

In these notes it is stated that onion black mould (*Aspergillus niger*) [*R.A.M.*, xiv, p. 553] occurs in New South Wales under field conditions, but serious losses are not as a rule experienced except in bulbs kept for some time in storage. Infection begins on the outer scales and spreads inwards, the inner scales being attacked through the neck of the bulb. A path is thus opened for secondary infections.

Onion smudge (*Colletotrichum circinans*) [loc. cit.] generally occurs as a light infection of the fleshy scales, resulting in a reduction in market value, but if the bulbs are harvested under wet conditions, and not dried properly before being bagged, serious losses may follow, including shrinkage in storage and increased susceptibility to various rots. The disease is almost entirely confined to white varieties. Both smudge and black mould are amenable to control by the removal of all affected bulbs at digging, thorough drying before marketing, storage under cool, dry conditions, crop rotation, and the burning of diseased crop refuse.

SIMMONDS (J. H.). **Report of the Plant Pathological Section.**—*Rep. Dep. Agric. Qd, 1937–38*, pp. 36–9, 1938. [Received May, 1939.]

The following items of interest occur in this report [cf. *R.A.M.*, xvii, p. 376]. Hyperplasia or 'wallaby ear' was very prevalent on late planted maize crops in Southern Queensland. This condition, which is stated to have only rarely reached serious proportions during the last 30 years, is characterized by stunting of the plants, shortened, stiff, erect leaves with the margin incurved, the blade crinkled, and the veins hypertrophied, by reduced or inhibited tassel formation, and sometimes even complete unproductiveness. Heavy rainfall coupled with high humidity and temperature are thought to exert an adverse effect on the growth of young maize plants, resulting in the production of the disease.

F. W. Blackford found *Rhizoctonia* [*Corticium*] *solani* associated with a rotting of tobacco stems [ibid., xvi, p. 841] near ground-level, causing considerable losses in young plants.

Following heavy rains in May serious losses occurred from a severe fruit fall of mandarins (chiefly Emperor of Canton variety) and of matured early oranges. The first symptom was a breakdown of the rind, causing a water-soaked area near the stylar, or less frequently the stem end of the fruit. The trouble is greatly increased when the rainy period is followed by a sudden cold spell. It is considered to arise from the excessive absorption of water by the rind of mature fruit, and consequent liberation of oil, both externally and internally.

Yellow crinkle of papaw [ibid., xvii, p. 259] has remained in a quiescent state since the somewhat serious outbreak in 1937, and where diseased plants were systematically eradicated little further development has been noticed. A new disease of papaw, suspected to be of virus origin, was observed for the first time in one locality and is characterized by an upward bending of the leaf-stalks and an abnormal development of the veins, which are broadened at the expense of the somewhat reduced blade. Serious die-back of papaw [loc. cit.] developed during the late autumn of 1938.

In experiments on the control of little leaf of apple [ibid., xviii, p. 261] promising results were obtained with a spray containing zinc sulphate. Grape anthracnose (*Elsinoe ampelina*) [ibid., xvii, p. 730] was satisfactorily controlled by four or five applications of Bordeaux mixture, commencing at bud burst, while the untreated vines sustained a complete loss. The sulphuric acid-iron sulphate swab proved of little value and is not recommended for inclusion in the spraying programme.

In H. E. Young's fertilizer experiments complete control of the fused needle disease of *Pinus* spp. [ibid., xviii, p. 491] was achieved with some of the treatments, but soil analyses supplied no explanation for these beneficial results. Soil acidification improved the condition, while liming depressed growth; spraying with zinc sulphate gave entirely negative results. Connecting diseased trees by means of a large number of root grafts to healthy trees gave negative results at first but led eventually to a considerable degree of recovery.

Six out of eight introduced mycorrhizal fungi belonging to the genus *Boletus* [cf. ibid., xv, p. 596], used for inoculating sterile *P. caribaea* seedlings, produced a significant increase in plant development as compared with that obtained with the native Queensland mycorrhiza, *B.*

*viscidus* giving particularly good effects. The causal agent of the leaf cast disease of Kauri pine [*Agathis australis*] was shown by successful inoculations of both *A. palmerstoni* and *A. robusta* to be a species of *Hendersonula*. *Rhizoctonia* root rot of hoop pine [*Araucaria cunninghamii*: ibid., xvi, p. 155] was successfully transmitted by soil inoculation in the glasshouse. The perfect stage of this fungus appears to be *Helicobasidium compactum* [see below, p. 546].

Shirlan AG proved an efficient preventive of moulds in eggs [ibid., xviii, p. 180], both under cold storage and room temperature conditions.

On pp. 40–44 of the same report H. K. Lewcock gives information on pineapple diseases and their control. A soil deficiency disease peculiar to the Caboolture-Beerwah area, called 'crookneck' because of the manner in which the heart leaves twist together and lean to one side, was markedly reduced in young plants by spraying with a solution of boracic acid at monthly intervals. The disease usually appears during the early stages of growth, plants propagated from slips or crowns being much more susceptible to it than those from suckers. A severe and widespread outbreak of marbling [ibid., xiv, p. 216] occurred about the middle of the summer. Field inoculation experiments showed that two, or possibly three, distinct bacteria [unspecified] may cause the disease, the typical symptoms of which were successfully reproduced in pineapple fruits. The disease is usually associated with low sugar content and low acidity. *Penicillium* sp. and *Fusarium* sp. were found to induce the brown speck condition in pineapple fruits, the infected tissue being also frequently invaded by various secondary organisms. The two fungi are relatively weak parasites and infection is determined, among other factors, by weather conditions and the chemical composition of the ripening fuit. Inoculation experiments were for this reason somewhat inconsistent. Black heart of pineapple [ibid., xv, p. 281], a physiological disorder correlated with low temperature conditions and therefore almost entirely restricted to the winter months, was found to be associated with a low sugar concentration in the fruit tissue. The disease occurred to a much greater extent in fruits picked when immature than in those gathered when fully ripe.

THOMPSON (A.). **Notes on plant diseases in 1937–1938.**—*Malay agric. J.*, xxvii, 3, pp. 86–98, 6 figs., 1939.

In addition to *Fomes noxius* and *Ganoderma lucidum* [*R.A.M.*, xvii, p. 314], a third fungus, probably a Polypore, is recorded causing a slowly developing stem rot of oil palms in Malaya. During periods of dry weather *Pestalozzia palmarum* was observed causing greyish-brown lesions, and *Helminthosporium* sp. causing a darker brown, linear leaf spot of oil palms. The latter fungus failed to cause damage in inoculation experiments and is considered a facultative parasite. A curious bending of the petioles of the oldest leaves of mature oil palms [ibid., iv, p. 84] occurred on a peat area, possibly owing to a nutritional disturbance, as the palms had been regularly manured with rock phosphate for some years. Species of *Mucor*, *Fusarium*, *Aspergillus*, and *Trichoderma* were found to develop on oil palm kernels after de-pericarping.

Heart rot has caused steady monthly losses of young pineapple plants in Johore, although not in sufficient numbers to cause alarm. The

symptoms of the disease closely resemble those attributed to *Phytophthora* in Hawaii [ibid., xv, p. 378], but the fungus has not been isolated locally. The results of inoculation experiments indicated that *P. parasitica* and *P. palmivora* can attack the plants under certain conditions.

Red root disease of tea (*Ganoderma pseudoferreum*) [ibid., xvii, p. 202] was observed to cause a rather sudden wilt, killing apparently normal bushes within a week. Infection was frequently traced to a jungle or shade tree stump, the common shade trees *Albizzia* [*moluccana*] and *Gliricidia* [*maculata*] both being susceptible to the fungus. The sudden onset of the disease is attributed to the fact that sometimes only a few of the lateral roots may be affected and the normal functioning of the bush is not disturbed until the fungus has completely encircled the tap-root and penetrated into the cortex. Attempts were made to control the wilt by exposing the upper lateral roots and the tap-root to the air, as the mycelium of the fungus was known not to grow on such roots. The exposure did not harm the bushes, but the method was less safe than trenching.

*Ustulina zonata* [ibid., xvi, p. 153] is stated to be the most common cause of root disease of tea at Cameron Highlands. At Serdang the disease was invariably associated with old stumps of *Grevillea* [*robusta*] shade trees. Cultural studies definitely proved *Fomes noxius* [ibid., xvi, p. 798] to be the causal fungus of brown root disease of tea, which together with *Rosellinia* root rot [ibid., xvii, p. 202] is fairly common on tea at Cameron Highlands, where they are more important on seed-bearers than on field bushes.

The leaves of durian (*Durio zibethinus*) plants at Serdang were attacked by anthracnose (*Colletotrichum* sp.) and by a rim blight due to a species of *Phyllosticta*. *Diplodia* sp. caused a die-back of scions of bud-grafted plants.

A mildew isolated from young green fruits of rambutan (*Nephelium lappaceum*) from Johore was identified as *Oidium* sp., closely resembling *O. heveae* [ibid., xviii, p. 272], but inoculations of young rubber leaves gave no results.

Bacterial canker (*Phytomonas* [*Pseudomonas*] *citri*) [ibid., xviii, p. 234] occurred on Italian lime at Serdang, causing fewer and larger cankers than those typically formed on other citrus varieties, and producing circular lesions on the leaves.

A *Fusarium* sp. forming a *Nectria* stage in pure culture was isolated from a serious bark rot of the Mediterranean sweet orange at Serdang, but inoculations gave negative results. The disease appears to be identical with that reported from Java.

A fungus identified as *Calonectria diploa* (B. & C.) Wr. with a conidial stage *Fusarium juranum* was found to parasitize a Diaspid scale insect on pomelo seedlings and *Hevea* rubber leaves.

*Sphaerostilbe repens* is recorded on lemon trees [cf. ibid., xv, pp. 2, 717; xvii, p. 671] killed by a root disease at Kuala Kangsar, Perak, and the same fungus caused heavy mortality of casava growing in Lower Perak on heavy clay soil subject to waterlogging.

*Fomes noxius* was isolated from a brown decay at the base of the stem of an avocado pear tree at Serdang, and a fungus resembling *U. zonata* from the tap-root and one lateral root of this tree.

*Helminthosporium papayae* [ibid., xi, p. 662] and *Mycosphaerella caricae* [ibid., xv, p. 240] were associated with a leaf disease of the Morado variety of papaw at Serdang, recorded for the first time in Malaya.

A fungus of the *Coryneum* type was associated with a disease of nutmeg in the provinces Wellesley and Malacca, the symptoms being typical of the disease attributed in Java to *C. myristicae* [ibid., xiv, p. 152].

A leaf disease of minor importance caused by *Cercospora cruenta* [ibid., xvii, p. 843], occurred on beans [*Phaseolus vulgaris*] at Cameron Highlands.

*Phytophthora colocasiae* [ibid., xvii, p. 731] is recorded for the first time from Malaya on leaves of *Colocasia* from Langkawi Island.

The mushroom *Marasmius semiustus* [*M. stenophyllus*: ibid, xviii, p. 328], attacked Manila hemp [*Musa textilis*] at Serdang and Johore, causing in damp weather a premature withering of the older leaves, which on poor soil may lead to stunting and death of plants.

Rust (*Maravalia crotalariae*) [ibid., xvi, p. 839] caused appreciable damage to the foliage of *Crotalaria* spp. all over the country with the exception of Cameron Highlands, but the attacks were rarely fatal. Another rust occurring on *Tephrosia* has been identified in 1939 by H. Sydow as *Ravenelia tephrosiicola.*

A fungus identified by the Imperial Mycological Institute as *Pythium splendens* var. *hawaiianum* was found to be responsible for the outbreak of wilt of *Piper betle* in Perak in 1937.

WATERSTON (J. M.). **Report of the Plant Pathologist, 1938.**—*Rep. Dep. Agric. Bermuda, 1938*, pp. 22–34, 1939.

This report [cf. *R.A.M.*, xvii, p. 588] on plant disease work in Bermuda in 1938 contains the following items of interest. Early in January, a very heavy loss of Bliss Triumph potatoes resulted from an attack by *Phytophthora infestans* just before digging, with the result that the potatoes were exposed to infection while being dug, and speedily rotted in storage. Owing to very dry weather in March and April, the Irish Cobbler potato crop suffered severely from attack by *Actinomyces scabies*, and many potatoes could not be shipped.

*Fomes subroseus* [ibid., xvi, p. 646], the agent of red rot in the Bermuda cedar (*Juniperus bermudiana*), effects entry through old wounds or dead branches; affected trees are commercially worthless and easily blown over. *Pestalozzia unicolor* [cf. ibid., xvii, p. 361] is frequently associated (as a secondary invader) with blighted foliage of *J. bermudiana.* No single primary parasite appears to be responsible for the blight; neglect, leading to overcrowding, competition, and shading effects, seems to produce physiological disturbances and predispose the trees to attacks by secondary agencies.

Miscellaneous records include the following. Lima beans [*Phaseolus lunatus*] were severely damaged by a species of *Phyllosticta* associated with leaf lesions caused by *Bacterium phaseoli*, and were slightly affected by *Uromyces phaseoli* [*U. appendiculatus*]. Carnations, obtained as cuttings in England, were affected by wilt (*Fusarium culmorum*) [ibid., xvii, p. 460]; carnation rust (*Uromyces dianthi*) [ibid., xvi, p. 613] was controlled

by sulphur dusting. Foot rot (*F. bulbigenum*) caused some loss to freesia [ibid., xiii, p. 100] plants in the field. Big Boston and Improved Hansen lettuces were attacked by marginal blight (*Bact. marginale*) [ibid., xiv, p. 17]. Stump rot (*Phytophthora parasitica*) [ibid., xvi, p. 797] was locally severe on Eastern lilies [*Lilium longiflorum* var. *eximium*] during wet weather in January, where soil wash was present. The fungus responsible for black scale in lily bulbs and for a premature die-back of the plants in the field has been provisionally identified as *Colletotrichum gloeosporioides*. A die-back of loquat branches at flowering was provisionally attributed to *Bacillus amylovorus* [*Erwinia amylovora*: ibid., xvi, p. 230]. Papaw powdery mildew [*Oidium caricae*: ibid., x, p. 554] was prevalent during winter, especially on young seedlings, which were severely infected. Young salsify plants developed destructive infection by white blister (*Cystopus cubicus*) during spring.

**F[ederazione] I[taliana] T[ecnici] A[gricoli]. VIII Congresso internazionale di Agricoltura tropicale e subtropicale. Tripoli, Marzo, 1939.** [Italian Federation of Technicians and Agriculturists. Eighth international Congress of Tropical and Subtropical Agriculture. Tripoli, March, 1939.]—Roma, Tipografia 'Arte della Stampa', 1939. [158 pamphlets and 259 French summaries in portfolio.]

At the Eighth International Congress of Tropical and Subtropical Agriculture, held at Tripoli in March, 1939, K. Rouppert (pamphlet 37, 3 pp.) gave an account of field experiments carried out from 1935 to 1938 near Cracow, Poland, in which he obtained complete control of *Synchytrium endobioticum* on potato by treatment of the soil with lime and ammonium sulphate. According to Raciborski these mixtures liberate gaseous ammonia, which is fungicidal. The author considers that this soil treatment for disease control is applicable in all types of climate, and is particularly valuable in tropical and subtropical areas.

A. G. Cabrera (pamphlet 116, 9 pp.) stated that in the Canary Islands Panama disease (*Fusarium* [*oxysporum*] *cubense*) [*R.A.M.*, xii, p. 773] is only of secondary importance, at most, as a factor in the unsatisfactory condition of the banana plantations, which in many instances appears to be due to adverse soil factors. The use of brackish water containing 200 to 250 mg. of sodium chloride per l. has been largely responsible for the poor state of the bananas, especially in argillaceous, shallow, poorly drained soils with an impermeable subsoil. Some damage has also been caused by heavy applications of chemical fertilizers.

F. L. Hendrickx (pamphlet 120, 10 pp.) gives notes on the causes, symptoms, and control of a number of diseases of *Coffea arabica* found at Kiva, Belgian Congo.

L. Petri (pamphlet 121, 27 pp.) discusses, with a large number of examples, the question of the control of plant diseases in tropical and subtropical countries.

G. Trinchieri (pamphlet 122, 4 pp.) recommends the publication of an international list of fungicides, insecticides, and similar materials certified by the phytopathological service of the country of origin as efficacious and harmless to the plants treated.

C. Sibilia (pamphlet 123, 5 pp.) reports three new physiologic races

of *Puccinia graminis* on Italian wheat growing in Abyssinia in addition to the one previously reported [ibid., xvii, p. 732]. The new races are designated A.O.I. 2 (isolated from Sabaudia wheat growing in the district of Biscioftù), A.O.I. 3 (from Riale wheat from Ambò), and A.O.I. 4 (from Gentil rosso × Noè 46 Passerini wheat from Harrar). None of the four races was able to infect Reliance or Vernal wheat, while all produced heavy infection on the Mindum, Acme, and Einkorn varieties. In respect of their ability to infect these wheat varieties they resemble the Kenya strains. All four strains gave type 4 reaction on Mindum and type 3 or 4 on Acme. Races A.O.I. 2 and A.O.I. 3 are of moderate virulence, as is race A.O.I. 1; race A.O.I. 4 is markedly less virulent, though it gave type 4 infection on Khapli wheat, usually considered to be very resistant.

A. Sibilia (summary 222) describes a new race of *P. triticina*, designated Ll, from Libya. It appears to have no analogy with other Mediterranean races of *P. triticina*, except that it is unable to infect Malakoff wheat.

**Biologische Reichsanstalt für Land- und Forstwirtschaft Berlin—Dahlem. Wissenschaftlicher Jahresbericht 1937.** [Reich Biological Institute for Agriculture and Forestry at Dahlem, Berlin. Scientific Annual Report 1937.]—*Landw. Jb.*, lxxxvii, 5, pp. 567–720, 1 graph, 1939.

The following are among the numerous items of phytopathological interest in this report in addition to those already noticed from other sources. In greenhouse inoculations on potted apple trees (Charlamowsky, Golden Pearmain, Boskoop, and London Pippin grafted on Doussaint) in poor soil, those receiving nitrogen as the sole nutrient sustained heavier damage from scab (*Fusicladium*) [*Venturia inaequalis*], and those given a complete fertilizer were less severely affected, than the controls. Dr. Seeliger's observations at the Naumburg (Saale) branch showed that, of the progeny of *Malus* [*Pyrus*] *floribunda*, *M.* [*P.*] *halliana*, M. [*P.*] *toringo*, and *M.* [*P.*] *baccata*, all locally immune from scab and mildew [*Podosphaera leucotricha*], *Pyrus baccata* f. *genuina* yielded the maximum number of resistant seedlings.

Inoculation experiments by H. W. Wollenweber and H. Hochapfel with strains of *Coniothyrium tirolense* isolated from imported apples [ibid., xvii, p. 187] showed that the decay of pome fruits due to this fungus generally proceeds much less rapidly than that caused by *Diplodia* spp. Representatives of the latter genus under investigation included *D. pseudodiplodia* Fkl, the agent of bark blight and fruit rot of apple, pear, and plum, and three species derived from a number of exotic plants, such as coconut, citrus, banana, cacao, and *Cassia*, viz., *D. palmicola* (Fr.) Thüm., *D.* (*Sphaeropsis*) *paradisiaca* Mont., and *D. pandani* (Lév.) Tassi. With the exception of the last named, these species induced a rapid black rot of pome fruits.

H. W. Wollenweber isolated *Pezicula plantarium*, a new Discomycete, from a cortical blight of sweet cherries in a north German orchard. In pure culture the development of the pycnidia was followed after some months by that of cupulate, stalked, orange-coloured apothecia, 1 mm. in diameter. Apple and quince fruits inoculated with the fungus turned

black and rotten in five weeks. W. Bucksteeg's experiments with *Sclerotinia fructigena* and *S. cinerea* [*S. laxa*] from sour cherries [ibid., xvii, p. 687, cf. ibid., xviii, p. 401] in the Lower Elbe valley showed that the overwintered spores of these fungi can survive for a minimum period of six months at 18° C. W. Holz's studies on 'apoplexy' of plums and cherries in the same district revealed the implication of *Valsa cincta* and *V. leucostoma* [ibid., xv, p. 447]. Most of the stocks used for grafting in the affected orchards, especially myrobolan [*Prunus divaricata*], were found to possess a disproportionately high osmotic capacity in comparison with the scions. Good control was obtained by the excision of the lesions and painting the wounds with quinosol-vaseline.

In Dr. Seeliger's experiments on the varietal reaction of vines to downy mildew (*Peronospora*) [*Plasmopara viticola*], oospores of the fungus developed in the open only on highly susceptible varieties of the Vinifera group, but on cut leaves in Petri dishes at 25° they were produced in four to eight days on such resistant types as Arizonica, Berlandieri (G. 172), Californica, Riparia, Rupestris du Lot, Champinii × Rupestris G. 9 (Na. 263), Longii, Rupestris × Cinerea, Solonis, and hybrids between Vinifera and Aestivalis, Monticola, Riparia, and Rupestris. Dr. Gollmick's inoculation tests on vines with *Pumilus medullae* [ibid., xviii, p. 294] and Zweigelt's unidentified organisms M and N [ibid., xvii, p. 499] gave negative results in respect of the living wood, though the dead pith was readily colonized. True melanose (brown spotting) of vine leaves [ibid., viii, p. 223] was found by the same workers to be hereditary. The disease is of importance only when the green portions of the shoots are involved in addition to the mature wood; the European and some of the American varieties examined suffered from the milder form of the disease. Strict economy in the use of copper being essential, 23 preparations almost or entirely free from this element were tested against downy mildew by H. Zillig and Dr. Wilhelm at the Bernkastel-Kues (Moselle) branch, with satisfactory results only in seven cases. The efficacy of 0·25 per cent. Bordeaux mixture was increased by an admixture of lime-sulphur and neutral paste, but not by that of 0·2 per cent. colloidal sulphur. A high degree of toxicity to the zoosporangia of the fungus was manifested by hypoflavin and quinosol, and also (in acid solutions only) by aluminium compounds.

Good control of *Didymella lycopersici* on tomatoes [ibid., xvi, p. 801] was secured by H. Orth by the disinfection of the training wires with 1 per cent. formalin, which reduced the incidence of infection from 47·5 to 12·8 per cent. *S*[*olanum*] *racemiflorum*, *S. racemigerum*, and *S. pruniforme* proved highly resistant to the fungus in two years' greenhouse and field tests.

The Delikatess cucumber was found by H. Schultz to be very resistant in the field to *Cladosporium cucumerinum* [ibid., xi, pp. 688, 690], which showed evidence of physiologic specialization.

In Dr. Heiling's pot experiments complete control of *Plasmodiophora* [*brassicae*] on cabbage was obtained by the application to the soil of mercuric chloride, mustard oil, or formalin at the rates of 0·15 gm., 3 c.c., and 1·5 c.c. per l. soil, respectively. Field experiments gave essentially comparable results, except in the case of formalin, which

proved ineffectual. The infective capacity of the spores was practically destroyed by half an hour's immersion in water heated to 70°. The water absorption and transpiration of infected cabbage and mustard plants were found to show an initial increase followed by a rapid and persistent decline. In H. Pape's experiments in the Schleswig-Holstein marshes the disease was effectively combated by strewing blue sand from the subsoil over the surface of the soil. The Seefeld turnip showed outstanding resistance in varietal reaction trials, Pomeranian Tankard and Heinkenborstel also sustained little damage, but Wilhelmsburg was heavily attacked.

W. Straib's studies on physiologic specialization in *Melampsora lini* on flax [ibid., xvi, p. 612] resulted in the separation of five races, two of which corresponded exactly in their mode of infection on 349 out of 350 varieties but differed appreciably on the remaining one. Most of the resistent or immune varieties belonged to the South American oil-yielding types.

Surprising inconsistencies in the reactions to races 13, 20, 31, and 19 of brown rust of wheat (*Puccinia triticina*) [ibid., xvii, p. 733] were observed by K. Hassebrauk in the standard Carina and Brevit varieties under different environmental conditions. At low temperatures, for instance, these varieties acquire resistance to all the races attacking them at high ones, and it is doubtful whether the separation of certain races hitherto regarded as distinct, e.g., 13 and 20, can be maintained in future.

The aphid *Doralis* [*Aphis*] *rhamni* was experimentally shown by K. Heinze to transmit 'browning' (cucumber virus 1) from diseased to healthy lupins [ibid., xvi, p. 680], of which the alkaloid-free *Lupinus angustifolius* was chiefly used in the tests. The symptoms are completely masked in greenhouse lupins, and infection could only be verified by the inoculation of test plants with the expressed juice by rubbing. The following plants were found to harbour the virus: *Viola tricolor*, *Aquilegia vulgaris*, *Scabiosa maritima* var. *atropurpurea*, *Senecio elegans*, *Eryngium planum*, wallflower, *Zinnia* sp., *Chelidonium* sp., spinach, tomato, *Stellaria media*, *Capsella bursa-pastoris*, and *Galinsoga parviflora*.

**Versuchs- und Forschungsanstalt für Wein-, Obst- und Gartenbau Geisenheim a. Rh. Wissenschaftlicher Jahresbericht 1937.** Scientific Annual Report for 1937 of the Experimental and Research Institute for Viticulture, Fruit-Growing, and Horticulture at Geisenheim-am-Rhein.]—*Landw. Jb.*, lxxxvii, 3, pp. 345–382, 1939.

This report contains the following among other items of phytopathological interest [*R.A.M.*, xvi, p. 230]. An intensive study was made by C. F. Rudloff and collaborators of the twig infection phase of pear scab (*Venturia pirina*), the cytological development of the pustules being investigated, the mode of dissemination of the conidia followed, and preliminary control experiments initiated. In addition to excision of the diseased material very satisfactory results were given by the application to the trees of a saturated 'network' of Bordeaux mixture: the showers that liberate the scab conidia simultaneously release sufficiently large amounts of copper to preclude infection in most cases.

This principle of the 'ever-ready spray reservoir' also underlies to some extent the practical and effective 'blue' treatment [ibid., xvi, p. 541 *et passim*]. The blossoms were not injured by the copper in the orchard tests, though in the laboratory the germinability of pollen of different varieties was impaired by contact with a $\frac{1}{5000}$N copper sulphate solution. The movements of the conidia were studied by means of a specially constructed apparatus known as a 'conimeter' (C. Zeiss, Jena); these spores were found to be almost exclusively responsible for the establishment of primary infections, the ascospores being of little importance in this connexion during the period under review. Greenhouse inoculation experiments on about 200 trees in tubs and one-year-old potted grafts revealed variations in the 'aggressiveness' of the different physiologic races corresponding to the morphological peculiarities of the hosts. The best method of combating storage scab was found to lie in the rational fungicidal treatment of the fruits during the growing period.

A number of vine selections resistant to *Plasmopara viticola* have been obtained by planting the vegetative progeny of the best Riesling clones in the open and exposing them to spontaneous infection.

In further studies by F. Stellwaag and assistants on the heritability of 'reisigkrankheit' of the vine [ibid., xviii, p. 86] in some 1,800 seedlings no differences in vigour could be detected between the progeny of healthy × diseased parents and those of the reciprocal cross; the incidence of double nodes was as follows: healthy × healthy 1·3, diseased × diseased 1·6, diseased × healthy 1·2, and healthy × diseased 0 per cent. The germinability of pollen from diseased vines tends to be reduced in comparison with that from sound material. An examination of the auxin content of 'reisig'-diseased and healthy vine shoots showed that, although the accessory growth factors are just as well represented in the more vigorous affected shoots as in sound ones, the total content of the former is apt to be inferior owing to their general failure to attain the normal diameter.

K. Hening and co-workers successfully inoculated both wounded and uninjured grapes of the thick-skinned dessert variety Blue Ox-eye, with *Botrytis cinerea* [ibid., xviii, p. 295], the dense mycelium of which covered the substratum in a week. Experiments were also carried out in the inoculation of crates of Riesling grapes with dry spores of the fungus with a view to imparting a characteristic aroma to the must. In some cases vitamin B was added to stimulate the immediate development of the spores, with very satisfactory results. The flavour of the treated product was sufficiently palatable to justify the use of the method in seasons when the natural bouquet of the must needs improvement.

*B. cinerea* was observed by C. Rudloff to occur in a parasitic form [cf. ibid., xvii, p. 686] on Mefo white chrysanthemum blooms, producing small, rust-coloured, red-bordered spots and larger greyish-brown ones.

Riker (A. J.). **Physiological relations between host and parasite in crown gall—an example of basic biological research with plant material.**—*Amer. J. Bot.*, xxvi, 3, pp. 159–162, 3 figs., 1939.

This is an abridged version of a paper summarizing recent research

on crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xviii, p. 381] read in December, 1938, before the American Association for the Advancement of Science.

Snieszko (S. F.) & Paluch (J.). **The influence of some digestive ferments on the experimental crown-gall.**—*Science*, N.S., lxxxix, 2305, p. 200, 1939.

This work on crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) has already been noticed from another source [*R.A.M.*, xviii, p. 296].

Mehta (K. C.). **The dissemination of cereal rusts in India.**—*Proc. Indian Sci. Congr., 1938*, Part iv, pp. 137–140, 1939.

Opening a discussion on the dissemination of the cereal rusts [*Puccinia* spp.] in India the author sums up the present state of knowledge on the subject [*R.A.M.*, xiii, p. 499]. Observations made on wind curves seem to indicate that the rusts are disseminated from hill stations where they survive the summer temperatures and where, on account of early sowings, they are found a few weeks earlier than in the plains. In order to prevent this spread, wheat and barley should not be sown anywhere in Nepal before October, and in the Nilgiris and Palni hills the first crop of wheat and barley, usually sown between April and June, should be discontinued. In addition all self-sown plants and tillers of wheat and barley should be rigorously destroyed in all hilly districts one to two months before the sowing. In the discussion which followed, these recommendations were supported by Prof. A. H. R. Buller and others.

Boewe (G. H.). **Range extensions for Naucoria cerealis in Illinois in 1938 and a key to certain species in the genus.**—*Plant Dis. Reptr*, xxiii, 2, pp. 24–27, 1939. [Mimeographed.]

As a result of field work in 1938, the known distribution of *Naucoria cerealis* [*R.A.M.*, xviii, p. 164] in Illinois has been extended to cover five new counties. A key is given of all species of *Naucoria* known or presumed to be associated with living plants.

Goddard (Mary). **Studies on variation in Gibberella saubinetii (Mont.) Sacc. (Fusarium graminearum Schwabe).**—*Ann. Mo. bot. Gdn*, xxvi, 2, pp. 99–164, 8 pl., 1 fig., 1 diag., 1939.

In studies at the Missouri Botanical Garden on the influence of environmental conditions on variation in *Gibberella saubinetii* [*R.A.M.*, xviii, p. 97], 98 conidial isolates of two strains of the fungus were grown on potato dextrose agar and then transferred to various media to determine the relative stability of the strains. Only one variant remained stable through five generations in one strain and two in the other, while all the other variants eventually reverted to the parental type. These three stable variants and six other conidial isolates were then grown on Brown's, Coons's, Leonian's, Richards's, and potato dextrose agar at 18°, 20°, 25°, and 30° C., and produced both 'eco-variants' (temporary variants due to environment) and permanent variations. Both occurred more readily at the lower temperatures on

Leonian's agar, which was also the best medium for development, the optimum growth temperature being 25°.

Grown on five different media and at four different temperatures cultural sectors of the mycelial type, which had previously formed no conidia, produced these organs in large numbers, while those of the conidial type changed to aerial forms and yielded either very few or no conidia. In a series of transfers a culture was observed to pass from the aerial mycelial phase through the conidial and the appressed to the pionnotal and back again to the aerial mycelial phase, the latter being comparable to the description of the original ascospore isolate of the fungus from maize stubble. On the basis of these observations it is tentatively suggested that these variations represent different phases in the cycle of growth through which the fungus passes, and not separate strains within the species.

When two contrasting strains of the fungus were allowed to germinate on the same drop of agar or the mycelia were mixed, no new or intermediate strains were produced, and although nuclear migration occurred in hyphal anastomoses no instance of caryogamy was observed.

The fact that two identical variant sectors are often formed on the culture plate about the same time is interpreted as indicating that the saltation is somatic rather than germinal, as the soma would tend to saltate more or less simultaneously at diverse points, while germinal changes are usually somewhat haphazard and would, even if there were two in the same culture, most probably not be identical.

Straib (W.). **Der Einfluss des Entwicklungsstadiums und der Temperatur auf das Gelbrostverhalten des Weizens.** [The influence of the stage of development and of temperature on the reaction of Wheat to yellow rust.]—*Phytopath. Z.*, xii, 2, pp. 113–168, 3 figs., 1 graph, 1939.

In studies carried out at Gliesmarode, Brunswick, from 1934 to 1938 on the reaction of wheat to physiologic races 2, 7, and 9 of yellow rust (*Puccinia glumarum*) in relation to the prevailing temperature and stage of development of the plants [*R.A.M.*, xviii, p. 167], three groups were differentiated, viz., (1) acquiring enhanced resistance with advancing age and lateness of the season ('summer resistance'), (2) equally susceptible at any age and all times of year, and (3) uniformly resistant at temperatures above 10° C. Group (1) includes Criewener 104, Stocken, Hörning's Grüne Dame, Garnet, and Svalöf's Kronen (in respect of all three races), and Strube's Dickkopf, Baltikum, Rimpau's Hybrid, Cimbal's Grossherzog, Peragis Summer, and (under certain conditions) Minhardi and Roter Schlanstedt Summer (races 2 and 7); (2) Michigan Amber and Buffum (all three races), Heine's Club and Ridit (race 9), and Rouge prolifique barbu (race 2); (3) Heine's Club, Ridit, Aurora, and Czaribrod Spelt (race 2); the foregoing with the addition of Rouge prolifique barbu (race 7); Strube's Squarehead, Baltikum, Carsten's V, Spalding's Prolific (immune), Cimbal's Grossherzog, Salzmünde Standard, Svalöf's Kronen, Czaribrod Spelt, and Rouge prolifique barbu (race 9).

Parallel series of greenhouse experiments with plants at varying stages of development substantiated the conclusion drawn from earlier

investigations that summer resistance develops principally under the influence of rising summer temperatures. This was further exemplified by the observation that in the later stages of development certain varieties reacted to a rising temperature by considerably greater increases of resistance than the younger plants, especially seedlings. Varieties reacting in this way to the environmental factors concerned are virtually immune from yellow rust during the main growing period (May to July), but may bear a profusion of pustules in the autumn and winter. The intensity of resistance acquired through the operation of high temperatures is naturally greater in hot than in normal or cool summers, while further modifications in a direction adverse to the host may be introduced by unbalanced nitrogenous manuring and simultaneous infection by *Tilletia tritici* [*T. caries*: ibid., xviii, p. 302]. The extreme degrees of summer resistance and susceptibility in many varieties may best be gauged in the field. Helen Hart's theory of functional resistance [ibid., xi, p. 562] is of some interest in connexion with the initiation of yellow rust infection, since differences were established in respect of germination rate between the various physiologic races.

A cold, dry spring (April to May) was found to restrict the dissemination of *P. glumarum* even in the presence of sufficient overwintered foci of infection, whereas warm and relatively humid conditions favour both fructification and fresh outbreaks. On the other hand, persistent heavy rains impede the activities of the rust. Thus a warm, dry June with heavy night dews may provide better conditions for the development and spread of yellow rust than a cool, rainy month, as long as the maximum temperatures for the viability of the mycelium are not exceeded for any considerable period. The bearing of these environmental factors on the practical aspects of comparative field and greenhouse trials is discussed, and the importance in the formation of correct judgements as to varietal reaction of uniformity in the prevailing temperature, light, and humidity conditions emphasized.

MEAD (H. W.). **Shrivelling of Wheat kernels by stem rust and its effect on seed value.**—*Sci. Agric.*, xix, 7, pp. 481–493, 1 fig., 3 graphs, 1939.

Direct examination and analysis of normal wheat seeds and of wheat seeds shrivelled by stem rust [*Puccinia graminis*] demonstrated that in the latter the dry weights of the embryos, fibre, and endosperm were, respectively, 41·6, 57·1, and 37·0 per cent. of those in the normal seed. The shrivelled seed germinated nearly as well as normal seed, but when sown in soil under greenhouse conditions it produced fewer and weaker plants than normal seed, these plants also emerging later, having smaller root systems, and being lighter in weight than the plants from normal seed. In field plot tests using seed inoculated with the common root-rot fungus, *Helminthosporium sativum*, the seedlings from the shrivelled seeds showed poor resistance to common root rot which produced more seedling blight than on plants from healthy seed, the reduction in emergence of normal and shrivelled seed being 11 and 40 per cent., respectively, and the corresponding reductions in yield 7 and 40 per cent. In greenhouse tests weak seedlings also suffered greater permanent damage from severe top injury than did normal ones, but they withstood freezing and prolonged drought as well as those

from normal seed. Treatment of the shrivelled seed with formalin seriously reduced germination and emergence, and appeared to make the seedlings very susceptible to *H. sativum*. Treatment with new improved ceresan and leytosan [*R.A.M.*, xvii, pp. 605, 797] was slightly beneficial. Good stands and yields were obtained in replicated field plot tests with the uninoculated shrivelled seed, many more grains of which were sown than of normal seed because of their shrivelled condition.

FITTSCHEN (H. H.). **Weitere Beiträge zur Züchtung steinbrandresistenter Weizensorten.** [Further contributions to the breeding of bunt-resistant Wheat varieties.]—*Phytopath. Z.*, xii, 2, pp. 169–218, 1939.

In this further extensive contribution to the technique of breeding wheat varieties for resistance to bunt (*Tilletia tritici*) [*T. caries*] in Germany on the lines laid down by Roemer and Bartholly [*R.A.M.*, xiii, p. 293], the writer presents additional evidence for the modifications in aggressiveness induced in different collections of the fungus by multiplication on certain test varieties, e.g., Hohenheimer 77 and Heil's Squarehead. The various 'lines' of a bunt population may also be distinguished in some cases by variations in the size of the spore balls, and in the effects induced on the height and tillering of the host.

The aggressiveness of a large number of new collections tested was in general of a low order initially, but could mostly be enhanced by reproduction on the standard assortment. Few of the winter and summer wheats (100 of each) inoculated with five individual bunt lines showed any appreciable degree of resistance, the best in the former category being the American varieties Oro, Martin, Minturki, and Ridit, and in the latter Greek 4 and 12, Spanish 9, *Triticum timopheevi* (immune from all five), and Hope. The inoculation of an assortment comprising Ridit, Hohenheimer 77, Heil's Squarehead, and Panzer III with spore mixtures of different lines resulted in a general lowering of infectivity, which was even more marked in the effects induced by the progeny of the blends on the same varieties with the addition of Hussar and White Odessa. Among the factors operating in this decline of virulence in the combinations as compared with pure lines of bunt are a diminution in the number of highly aggressive spores, differences in the extent and velocity of germination, and variations in sporidial production and in the abundance of production of mycelium [ibid., xviii, p. 303].

Discussing the problem of the method of choice for inoculation tests in connexion with breeding work, the writer advocates the use, in the first place, of a highly aggressive spore mixture to eliminate the most susceptible plants, followed by a similar procedure for the progeny of the remainder, and by the exposure of the survivors of this second trial to infection by individual virulent lines or races.

GUILLOCHON. **La lutte contre le charbon nu du Blé en Tunisie.** [The campaign against loose smut of Wheat in Tunis.]—*C.R. Acad. Agric. Fr.*, xxv, 11, pp. 448–452, 1939.

A note is given on the treatment of Florence × Aurora and other wheat varieties in Tunis by immersion in hot water (45 minutes at 45° and then 10 at 52° C.) against loose smut (*Ustilago tritici*) [*R.A.M.*, xvi,

p. 802]. This method of disinfection is stated to destroy the spores completely without causing more than 5 to 7 per cent. loss of germinative capacity. The apparatus consists of three parts: a vat with a capacity of 35 cu. m. for the water at 45°, another of 20 cu. m. for the second lot of water (52°), and a drier, fitted with five ventilators, on which the grain remains for two hours. About 200 quintals of seed-grain can be treated daily.

SIMMONDS (P. M.). **Root development in relation to root rots of cereals.**—*Sci. Agric.*, xix, 7, pp. 475–480, 1939.

In this paper the author discusses (with numerous references to the relevant literature) observations made in Saskatchewan on the relations between cereal (mainly wheat) root development and root rots, i.e., take-all (*Ophiobolus graminis*), browning root rot (*Pythium* spp.), apparently following nutritional disturbances, and the common root rot caused by *Helminthosporium sativum* and *Fusarium* spp. The conclusions reached may be summarized as follows. Cereal seeds that have become injured in any way always produce plants predisposed to attack by root-rot fungi. During the seedling stage (from germination until emergence of crown roots), when the plants are supported entirely by the seminal roots, root infections cause much injury, generally accompanied by shoot symptoms. Infection of the crown, crown roots, and tiller buds in post-seedling attack is particularly severe when the deeply penetrating seminal roots are also infected. Root-rot infections are in many respects comparable to mechanical injuries in both seminal and crown roots.

BRIGGS (F. N.) & STANFORD (E. H.). **Linkage of factors for resistance to mildew in Barley.**—*J.Genet.*, xxxvii, 1, pp. 109–117, 1939.

In further studies in California on the inheritance of resistance to mildew (*Erysiphe graminis hordei*) in crosses between the three resistant barley varieties Algerian, S.P.I. 45492, and Kwan and the susceptible Atlas [*R.A.M.*, xvii, p. 384] the three resistant were each found to differ from the susceptible by a single factor for resistance to the disease. The same factor (designated as the Algerian), differing from those previously detected in Hanna, Goldfoil, and Arlington Awnless, is common to both Algerian and S.P.I. 45492, while Kwan possesses yet another factor (Kwan). The genetic constitution of the eight mildew-resistant varieties so far investigated is expressed by means of formulae, based on the six different factors, the largest number recorded in connexion with any single plant disease. The Algerian and Kwan factors were found to be linked with a cross-over value of 9·81 per cent., based on $F_3$ data and agreeing substantially with computations from $F_2$ figures. The other four factors were inherited independently. The Algerian factor for resistance to *E. graminis hordei* revealed independent inheritance with the factor pair long-haired v. short-haired rachilla.

GADD (I.). **Några iakttagelser rörande förhållandet mellan graden av Fusariumsmitta å kärnorna och broddens overvintring hos Höstråg på Bergshamra vintern 1937–38.** [Some observations concerning

the relationship between the degree of *Fusarium* infection of the grains and the overwintering of young autumn-sown Rye at Bergshamra during the winter of 1937–38.]—*Medd. Frökontrollanst. Stockh.*, *1939*, 14, pp. 62–80, 2 figs., 1939. [German summary.]

Following a general survey of the development and present status of *Fusarium* research and control in various countries, with special reference to Sweden, where diseases of this group are stated to be very widespread and destructive, notably that caused by *F. minimum* [*Calonectria graminicola*: *R.A.M.*, iii, p. 727; xix, p. 21] on rye, the writer discusses and tabulates the results of an inspection, during the winter of 1937–8, of 128 samples of untreated rye seed-grain representing 14 varieties. The incidence of overwintering was graded according to a scale ranging from 0 (total loss) to 5 (no damage), and that of fungal infection by similar gradations in the reverse direction, i.e., 0 = complete freedom and 5 = very severe infection. The correlation coefficient for these two values was found to be as high as r = —0·860, affording confirmation of the exactitude of the methods in use at the Seed Control Institute. The data further provide reliable indications for directions regarding seed-grain.

No conclusive evidence emerged of differences in varietal reaction to primary infection, nor did the plants arising from severely diseased seed contract heavier damage than those proceeding from absolutely or relatively sound material, possibly owing to unfavourable local weather conditions for seed-grain infection in the summer of 1938. The most susceptible of the varieties tested was Agro (overwintering 0, incidence of infection 5) and the most resistant Oiva (5 and 1, respectively).

Lincoln (R. E.). **Host-parasite interactions with bacterial wilt of Maize.** *Science*, N.S., lxxxix, 2303, pp. 159–160, 1 graph, 1939.

When mixtures of virulent and avirulent strains of *Bacterium* [*Aplanobacter*] *stewarti* [*R.A.M.*, xvii, p. 238], the agent of wilt of maize, were inoculated (by means of hypodermic injections into the growing point) into resistant and susceptible inbred lines of maize seedlings, subsequent isolations at suitable intervals showed that the proportion of virulent to avirulent strains (as judged by the type of colony produced [loc. cit.]) underwent a change during passage through the host plant. On passage through a susceptible host the change was toward a higher proportion of avirulent types, an initial proportion of 50 virulent to 50 avirulent bacteria changing after a 15-day passage into one of 39 to 61, respectively. The rate of change was slow when the inoculum contained a high proportion of avirulent bacteria. On passage through a resistant host the change was toward a higher proportion of virulent types, the initial 50 to 50 proportion changing into one of 63 to 37. The rate of change was slow (up to 100 per cent. virulent organisms) when the inoculum was largely composed of virulent types and rapid in one containing few. Plotting these rates of change against the initial proportion of avirulent bacteria in the inoculum, the slope or regression of the rates is linear and equal to —1·1 in the susceptible, and to —1·7 in the resistant host. The changes went on progressively from the time of the inoculation to the

death of the plant. Virulent bacteria killed the susceptible host in 10 to 15 days, but only stunted the resistant one, while the avirulent bacteria stunted the susceptible host and caused only the first early lesions in the resistant one. It is suggested that the low degree of virulence of bacteria adapted to the susceptible host and the high degree in the resistant establishes a most advantageous host-parasite relationship, as the bacteria thus possess sufficient virulence to overcome the resistance of the host without killing it.

KOEHLER (B.) & HOLBERT (J. R.). **Combating Corn diseases in Illinois.**—*Circ. Ill. agric. Exp. Sta.* 484, 35 pp., 1 col. pl., 22 figs., 1938. [Received June, 1939.]

Brief, popular notes are given on the chief diseases affecting maize in Illinois and their control.

GOIDÀNICH (G.). **Le più importanti malattie del Sorgo, con speciale riferimento a quelle del Sorgo zuccherino.** [The more important diseases of Sorghum, with special reference to those of saccharine Sorghum.]—*Industr. saccar. ital.*, xxxii, 2, pp. 77–102; 3, pp. 166–168, 2 col. pl., 25 figs., 1939.

This is a valuable summary of the essential available information on the symptomatology, etiology, distribution, and control of the following diseases of sorghum, with special reference to the saccharine varieties: smuts (*Sphacelotheca sorghi*, of which the author recently received material from Bologna, *S. cruenta*, *Tolyposporium ehrenbergi* [*R.A.M.*, xvi, pp. 97, 598], *Sorosporium reilianum* [ibid., xviii, p. 373], present in Italy since 1910, and the less important *Ustilago sorghicola*, *U. bulgarica* [ibid., xii, p. 617], allied to *Sphacelotheca sorghi* and *S. cruenta*, respectively, *T. volkensii* in East Africa, and *Sorosporium simii* Evans, resembling *S. reilianum*); rust (*Puccinia purpurea*) [ibid., xviii, p. 375]; helminthosporiosis (*Helminthosporium turcicum*) [ibid., xviii, p. 438], anthracnose (*Colletotrichum graminicolum* and *C. andropogonis*) [ibid., xv, p. 494], leaf blight (*Phoma insidiosa*) [ibid., ix, p. 506], and bacterioses (*Bacterium andropogoni* [ibid., xv, p. 346], *Bact. holci* [ibid., xiii, p. 571], *Bact. holcicola* [ibid., xvii, p. 223], and the relatively insignificant *Bact. alboprecipitans*, *Bact. rubrilineans*, *Phytomonas rubrisubalbicans* [ibid., x, p. 129], *Aplanobacter stewarti*, and *Bact. vasculorum* [ibid., xiv, p. 354]; root rots (*Pythium arrhenomanes* [ibid., xviii, p. 444], *P. graminicolum* [ibid., xvii, p. 384], and *Macrophomina phaseoli* [ibid., xvi, p. 130]; collar rot (*Sclerotium delphinii*) [ibid., xviii, p. 182], occurring in Sicily; seedling blight (*Fusarium moniliforme*) [*Gibberella fujikuroi*: ibid., xiii, p. 59]; parasites of subsidiary importance (*Sphacelia sorghi* [ibid., x, p. 360], *Fusarium avenaceum*, *Ascochyta sorghina* [ibid., xvii, p. 388], *Cercospora sorghi* [ibid., xvi, p. 493], *C. longipes* [ibid., iv, p. 146], *Acrothecium lunatum* [*Curvularia lunata*: ibid., xv, p. 597], *Sclerospora sorghi*, *Botryodiplodia sorghi*, and *H. halodes* [ibid., xv, p. 465]); viruses (mosaic or *Saccharum* virus 1 [ibid., xiv, p. 258; xv, p. 558], Storey's grass mosaic or *Saccharum* virus 1 A [ibid., ix, pp. 560, 724], and stripe or *Zea* virus 1 [ibid., xiii, p. 225]).

Descriptions are also given of two diseases occurring in Italy, one known as 'red stripe' and believed to be due to a virus, and the other of

uncertain origin, characterized by dark ferruginous spots of varying size scattered over both leaf surfaces (red leaf spot). Red stripe, which is prevalent and severe, induces far-reaching anatomical and cytological degeneration in addition to the external symptoms of chlorosis, red striation, tissue necrosis, and perforation or laceration of the leaves. The most resistant varieties are Gigante, Honey, Vienna (all 100 per cent.), and Folger (80), while Japanese Honey is very susceptible (30).

A note is appended on the obscure etiology of sorghum blight, commonly referred to *Bact.* [*Bacillus*] *sorghi* [ibid., xvi, pp. 19, 588] but actually, according to the author's studies in Italy, associated with a complex of factors, including red stripe, aphids, bacteria, and various other parasitic organisms.

Rhoads (A. S.). **Limitations of the bark-scraping method in the control of gummosis and psorosis of Citrus.**—*Proc. Fla hort. Soc.*, li, pp. 114–127, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 10, p. 3959, 1939.]

Bordeaux paste, lime and sulphur paste, lime-sulphur paste and washes, zinc sulphate-lime paste, sodium hydroxide Bordeaux, and the same with lime-sulphur proved very satisfactory as coatings for scraped gummosis [*Phytophthora citrophthora* and *P. parasitica: R.A.M.*, xviii, p. 450] and psorosis [ibid., xviii, pp. 308, 438] lesions on citrus trees in Florida. Lime-sulphur appeared to be the most effective in expediting scaling and exfoliation of the outer cortical layer, the primary aim of the treatment. The proprietary preparations Black Sambo and protexol were highly injurious to the trees, while humisol, preservitol, Avenarius Arrow carbolineum, and dendrin of the same firm, though not deleterious, were no more effective than lime-sulphur.

Camp (A. F.). **Symptomatology of deficiencies and toxicities of Citrus.**—*Proc. Fla hort. Soc.*, li, pp. 145–150, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 10, p. 3949, 1939.]

The symptoms of zinc [*R.A.M.*, xviii, p. 308], copper, magnesium [ibid., xvii, pp. 169, 672], and manganese deficiencies, and of borax poisoning in citrus in Florida are described. Borax poisoning is brought about mainly by (1) the damping of culls in the grove and the careless inclusion of fruit that has been dipped in borax solution and not thoroughly washed afterwards, and (2) the leaving of borax-treated boxes in the field for protracted periods, during which the borax is washed off the boxes by rain and percolates into the soil surrounding the trees.

Reichert (I.). **Palestine : plant diseases of Citrus.**—*Int. Bull. Pl. Prot.*, xiii, 4, pp. 75 M–81 M, 1939.

A preliminary list is given of the fungal, bacterial, virus, and physiological diseases of citrus investigated at the Rehovoth Agricultural Research Station, Palestine, from 1923 to 1938.

Uppal (B. N.) & Desai (M. K.). **Koleroga disease of Areca Nut.**—*Curr. Sci.*, viii, 3, pp. 122–124, 2 figs., 1939.

The perpetuation of *Phytophthora arecae*, causing the koleroga disease of areca palm [*Areca catechu: R.A.M.*, xviii, p. 233] in North Kanara, Bombay Province, is difficult to explain since oospores of the fungus

have not been found under natural conditions. Results obtained by pairing strains of *P. arecae* [ibid., ix, p. 684] isolated from diseased nuts in different localities in North Kanara showed that the sexual strains of the fungus have become definitely isolated in different areas. Strains from the villages Tyagli and Analgar always produced oospores when paired with any one of the other six strains tested, but failed to do so when paired with each other. It is suggested that this localization of the two sexual strains may offer an explanation of the fact that oospore formation has not yet been discovered in nature.

WALLACE (G. B.). **A non-parasitic disease of Arabica Coffee.**—*E. Afr. agric. J.*, iv, 5, pp. 365–368, 3 figs., 1939.

*Coffea arabica* trees over five years old growing on native plots at an elevation of about 4,400 ft. on the western slopes of Kilimanjaro, Tanganyika Territory, are killed off each year by a condition producing canker-like symptoms on the main stem where the primary branches arise, and on the primary branches where the secondary ones originate. In these parts the bark is very rough and loose, and flakes off; the affected areas under the bark are flat or rather sunken; and in some places the wood is exposed. On the main stem the upper parts are most affected. Transverse sections through diseased branches showed arcs of very dark tissue in the outer rings. These arcs generally became covered with callus tissue, but occasionally the affected parts had failed to heal, and remained exposed and flat. Parts of the diseased bark contained thin wafers of calcium oxalate.

No insect or fungus was associated with the condition, which is attributed to the fact that the trees, as seedlings, had been planted by being pushed into small holes made with a stick; the stems were buried to a depth of six inches, and the roots were twisted and curled. Inadequate cultivation and frequent treading (the soil being apt to pack) had aggravated the condition.

CASTELLANI (E.). **Prima ricognizione fitopatologica in Africa Orientale Italiana.** [First phytopathological survey in Italian East Africa.]—*Agricoltura colon.*, xxxiii, 3, pp. 143–148, 1939.

During an eight months' tour of Eritrea and Abyssinia the author observed that coffee at Faghenà and Merara was widely infected by *Colletotrichum coffeanum* [*Glomerella cingulata: R.A.M.*, xvi, p. 796], the attack being generally confined to the leaves.

MILLER (P. R.). **A survey of Cotton boll rot diseases and the fungi associated with them.**—*Plant Dis. Reptr*, xxiii, 2, pp. 29–32, 1 map, 1939. [Mimeographed.]

In a survey made during 1938 in Virginia, North Carolina, South Carolina, Georgia, and Mississippi to obtain data regarding the prevalence and relative distribution of fungi associated with cotton boll rot, the results obtained [which are tabulated] showed that *Glomerella gossypii* [*R.A.M.*, xviii, p. 25] occurred in 133 out of 141 samples examined. Other fungi found included *Fusarium moniliforme* [*Gibberella*

*fujikuroi*] (in 107 samples), *F.* sp. (67), *Alternaria* sp. (112), and *Diplodia gossypina* (19). Long periods of dry weather were unfavoûrable to boll rot, but the high percentage of fields (94 per cent.) showing the presence of anthracnose may explain the wide distribution of *G. gossypii* as a cause of damping-off of cotton seedlings. The anthracnose symptoms produced differed from those described by Barre and Edgerton in that the lesions were smaller, and not sunken and brownish with a red border; moist, pinkish spore masses were seldom observed.

Costa (A. S.) & Forster (R.). **Nota preliminar sôbre uma nova molestia de virus do Algodoeiro—mosaic das nervuras.** [Preliminary note on a new virus disease of Cotton—vein mosaic.]—*Rev. Agric., S. Paulo*, xiii, 3–4, pp. 187–191, 8 figs., 1938. [English summary. Received May, 1939.]

Symptoms of vein mosaic, an apparently new virus disease affecting numerous varieties of cotton (*Gossypium hirsutum, G. barbadense, G. purpurascens, G. punctatum, G. klotzschianum*, and interspecific hybrids), including some of commercial importance, in São Paulo, Brazil, consist of stunting, shortening of the internodes (bunchy top), a dark green coloration of the leaves, generalized or broken mottling of the veins, rugosity of the lamina, and curling of the margins. Positive results were obtained in inoculation experiments on *G. trilobum*. The disorder under observation differs in various respects from ordinary mosaic [*R.A.M.*, xviii, p. 248], the former, for instance, involving only the veins or their immediate vicinity instead of the intercostal spaces, producing a rugose condition of the dorsal leaf surface absent in the latter, attacking Sakel and other varieties of *G. barbadense* semi-immune from mosaic, and being readily transmissible by grafting, an operation of great difficulty with mosaic material.

King (C. J.) & Parker (R. B.). **Angular leaf spot of Cotton in irrigated valleys of Arizona and New Mexico.**—*Plant Dis. Reptr*, xxiii, 2, p. 32, 1939. [Mimeographed.]

Investigations into the reason for the recurrence of cotton angular leaf spot (*Bacterium malvacearum*) [*R.A.M.*, xviii, p. 390] to a damaging extent in parts of Arizona and New Mexico, even when the rainfall was light and disease-free seed had been planted, showed that rapid spread resulted from the flow of irrigation water applied before volunteer 'carriers' had been removed.

Roubaud (E.) & Descazeaux (J.). **Action de certains champignons prédateurs sur les larves des Strongylidés du Cheval.** [The action of some predacious fungi on the larvae of equine Strongylidae.]—*Bull. Soc. Path. exot.*, xxxii, 3, pp. 290–295, 1 pl., 1939.

Details are given of experiments at the Institut Pasteur, Paris, in the capture and ingestion of the equine parasitic nematodes, *Strongylus* and *Trichonema*, by predacious fungi, of which the most powerful were *Dactylella bembicodes* and *Arthrobotrys oligospora*, while *D. ellipsospora* acted in a similar but weaker manner [*R.A.M.*, xviii, p. 310].

Siemaszko (W.) & Jaworski (J.). **La coloration du substratum dans les cultures du Beauveria globulifera (Speg.) Picard et les bactéries.** [Bacteria in relation to the discoloration of the substratum in cultures of *Beauveria globulifera* (Speg.) Picard.]—*Bull. Soc. mycol. Fr.*, liv, 3–4, pp. 245–250, 1938 (issued March, 1939).

Various authors have regarded the capacity of species of *Beauveria* to colour the culture medium as a valid specific criterion. In investigations described in this paper a strain of *B. globulifera* [*R.A.M.*, xvii, p. 816] isolated from *Pentatoma rufipes* was found to produce an intense red coloration on potato and an orange coloration in a mineral salts-glucose-agar medium. This coloration was shown to be due to the presence of contaminating bacteria; out of 20 new monosporidial cultures of the fungus only three showed a faint colouring and these cultures were also found to be contaminated with bacteria. Evidence from experiments with monobacterial cultures confirmed the view that the cause of the coloration is not in the fungus itself but in the generally antagonistic bacteria which accompany it.

Marchionatto (J. B.). **'Septobasidium saccardinum' (Rangel) n. comb.** —*Rev. Fac. Agron., La Plata*, Ser. 3, xxii, pp. 59–63, 1938. [Spanish. Received June, 1939.]

A comparison of herbarium specimens of *Septobasidium curtisii*, supplied by J. N. Couch from North Carolina, and a fungus previously referred by the author to *Peziotrichum saccardinum* Rangel [*R.A.M.*, xiv, p. 98] showed that the latter, occurring in the Argentine on *Aspidiotus perniciosus*, is a species of *Septobasidium* but distinct from *S. curtisii*. *P. saccardinum*, which differs from *S. curtisii* in the smaller dimensions (14 to 16 by 3 to 3·5 $\mu$) and smooth texture of its spores (those of *S. curtisii* being traversed by numerous grooves), is renamed *S. saccardinum* (Rangel) n. comb.

Baldacci (E.). **Ricerche sul potere patogeno dei miceti. I. Esperienze con la Beauveria bassiana (Bals. Criv.) Vuill. sul Bombyx mori L.** [Researches on the pathogenic power of fungi. I. Experiments with *Beauveria bassiana* (Bals. Criv.) Vuill. on *Bombyx mori* L.]—*Atti Ist. bot. Univ. Pavia*, Ser. IV, xi, pp. 154–189, 4 graphs, 1939. [Latin and English summaries.]

Inoculation experiments in which nearly 60,000 silkworms (*Bombyx mori*) were sprayed with an aqueous suspension of the spores of two strains of *Beauveria bassiana* [*R.A.M.*, xviii, p. 379] showed that pathogenicity depended on germinability and on enzymic activity on chitin. Loss of enzymic power was found to precede that of germinability, and spores about ten months old were no longer pathogenic, though still germinable, and cultures from these spores were able to cause infection. Strains kept in culture for long periods were only weakly pathogenic, but regained their original pathogenicity after one passage through the silkworm.

These results do not suggest that any change should be made in the usual precautions taken against muscardine disease due to *B. bassiana*. On the other hand, they provide some explanation of the failure to

control injurious insects by means of fungal infection. Only a small proportion of spores reaches the insects, the remainder dying or losing their germinability and vegetating on inert substrata. In addition, environmental and climatic factors may not favour infection.

[A condensed version of this paper appears in *Boll. Soc. ital. Biol. sper.*, xiv, 1, pp. 52–53, 1939.]

Grigoraki (L.) & David (R.). **Caractères biochimiques de Trichophyton asteroides (Sabouraud 1909).** [Biochemical characters of *Trichophyton asteroides* (Sabouraud 1909).]—*C.R. Soc. Biol., Paris*, cxxx, 9, pp. 889–891, 1939.

Continuing their investigations on the biochemical features of the dermatophytes [*R.A.M.*, xviii, p. 393], the writers found that *Trichophyton asteroides* [*T. mentagrophytes*: ibid., xviii, p. 177] from Sabouraud's agar requires a period of some 56 days at 20° C. to dissolve the casein in sterilized skimmed milk; the liquefaction of gelatine at the same temperature commences feebly on the third day. The following colorations developed in cultures at 35° after 30 days in the presence of mannose, glucose, galactose, saccharose, maltose, lactose, inulin, dextrin, and glycerine (15 c.c. per tube and a dozen drops of litmus): reddish-orange 78D, reddish-orange 86, reddish-orange 61, red 11, red 16, red 11, red 36, red 28D, and red 16 (Klincksieck & Valette), respectively. A barely perceptible currant-red tinge denoted the production of indol after about a month.

Minami (S.) & Hara (Y.). **Ein Fall von Sycosis trichophytica.** [A case of sycosis trichophytica.]—*Hitu-to-Hitunyo, Hukuoka* vii, pp. 54–59, 1939. [Japanese. Abs. in *Zbl. Haut- u. GeschlKr.*, lxii, 5, pp. 279–280, 1939.]

*Sabouraudites asteroides* [*Trichophyton mentagrophytes*: see preceding abstract] was found to be the responsible agent in a case of sycosis trichophytica in a 29-year-old man treated at the Fukuoka (Japan) University Dermatological Clinic.

Catanei (A.). **Étude des teignes du cuir chevelu dans les colonies françaises.** [A study of scalp ringworms in the French colonies.]—*Ann. Inst. Pasteur Algér.*, xvii, 1, pp. 47–57, 1 pl., 1939.

In this first inquiry into the etiology of scalp ringworms in the French colonies, *Trichophyton soudanense* [*R.A.M.*, xviii, p. 177] was found to be responsible for most (31) of the cases of trichophytosis in French West and Equatorial Africa, *T. violaceum* being isolated from nine, and *T. gourvili* [ibid., xiii, p. 577] from five. *T. fumatum* [ibid., xviii, p. 177] was found in one case in Madagascar. Microsporosis in Africa was associated with *Microsporon obesum* [ibid., xvii, p. 175] (21), *M. audouini* (14), *M. audouini* and *T. soudanense* (2), and *M. tardum* [ibid., xvii, p. 599] (1). In the French Indies (Pondicherry) *T. violaceum* was established as the causal organism in nine cases, *T. sulphureum* [ibid., xviii, p. 177] in two, and *T. sulphureum* and *T. violaceum* in one. *T. rubrum* [ibid., xvii, p. 819; xviii, pp. 27, 110, 178] was isolated from two cases and *M. ferrugineum* [ibid., xviii, p. 110] from three in Indo-

China. In inoculation experiments *T. sulphureum* was pathogenic to the guinea-pig and monkey (*Macacus inuus*) and *T. violaceum* (Cameroon strain) to the former.

Mu (J. W.) & Kurotchkin (T. J.). **Statistical and mycological studies of dermatomycoses observed in Peiping.**—*Chin. med. J.*, lv, 3, pp. 201–219, 1939.

Cultural studies were carried out in 29 out of the 92 cases of favus of the scalp examined at the Peiping [Peking] Union Medical College Hospital during the period from 1925 to 1938, in 664 out of 1,104 of tinea [or ringworm] of the scalp, in 47 out of 760 of tinea of the body, in 71 out of 526 of tinea of the hands and feet, and in 16 out of 49 of tinea of the nails. The common clinical features of the five types of mycotic infection are described. Favus of the scalp was most prevalent among male children and young adults of the poorer classes, a similar distribution being characteristic of tinea of the scalp. Males were also more commonly affected by tinea of the body than females. Tinea of the hands, feet, and nails occurred indiscriminately in persons of both sexes and all social strata. Both favus and tinea of the scalp predominated during the spring, while the other disorders were mostly encountered in the summer.

*Achorion schoenleini* was found to be responsible for all 29 cases of favus of the scalp, *T. violaceum*, *T. ectoendothrix* [cf. *R.A.M.*, x, p. 243], *M. ferrugineum* [see preceding abstract], *T. glabrum*, and *T. cerebriforme* [ibid., xvii, p. 599] for tinea of the scalp (382, 99, 92, 85, and 6, respectively), while *Epidermophyton* [*T.*] *rubrum* [loc. cit.] was mainly concerned in tinea of the body (36), hands and feet (59), and nails (15). *M. ferrugineum* developed in two forms, one characterized by pale yellow, superficially convoluted colonies, with a short, white 'duvet' and the other by an orange-tinged, glabrous, more extensively convoluted growth. *Endodermophyton tropicale* [*T. concentricum*: ibid., xvii, p. 818] was present in three cases of tinea of the body and *Epidermophyton inguinale* [*E. floccosum*] in twelve of tinea of the hands and feet and one of tinea of the nails. There were a number of cases of mixed infection, *T. violaceum* being associated with *T. endoectothrix* in four and with *M. ferrugineum* in 21.

Kurotchkin (T. J.). **The value of Gram stain for differentiation of pathogenic fungi.**—*Chin. med. J.*, *Suppl.* 2, pp. 337–341, 1938. [Abs. in *Bull. Inst. Pasteur*, xxxvii, 6, p. 362, 1939.]

Among the 120 species of fungi pathogenic to man examined by the writer for their reaction to Gram's stain, some were entirely positive, e.g., *Trichosporon* spp. and *Acrotheca* [*Hormodendrum*] *pedrosoi* [*R.A.M.*, xviii, p. 28], others completely negative (many *Trichophyton*, *Achorion*, *Microsporon*, and *Endodermophyton* spp.), while certain organisms, including six species of *Epidermophyton*, *M. fulvum* [ibid., xvii, p. 174], *A. gypseum* [ibid., xvii, pp. 36, 395, 529], and *Aspergillus fumigatus* were negative as regards the mycelium and positive in respect of the spores, and a few, such as *Sporotrichum*, were negative except for their granular contents.

Kambayashi (T.). **Über eine aus dem menschlichen Nagel kultivierte Endodermophyton-Art.** [On a species of *Endodermophyton* cultured from the human nail.]—*Bot. Mag., Tokyo*, liii, 628, pp. 163–168, 1 fig., 1939.

From the finger-nails of a 26-year-old bath attendant suffering from acute onychomycosis, the writer in 1937 obtained in pure culture on various standard media a fungus characterized by a branched, septate mycelium, 4 to 4·5 $\mu$ in diameter, and concatenate, intercalary, and terminal chlamydospores, 9 to 20 $\mu$ in diameter. On 4 per cent. glucose agar the organism, which is considered to be closely related to *Endodermophyton tropicale* (*E. concentricum*) [*Trichophyton concentricum*: see preceding page], forms cerebriform to furcate, partially concentric colonies of a dirty whitish, faintly amber-tinted colour.

Morikawa (T.). **Über Dermatitis verrucosa cephalosporica.** [On dermatitis verrucosa cephalosporica.]—*Mycopathologia*, ii, 1, pp. 60–67, 3 pl., 1939.

A brief description is given of the morphological and cultural characteristics of a fungus isolated from a case of human verrucose dermatitis in Tokyo, the abundant presence of which in the affected tissues leaves little doubt of its being the cause of the disease; the organism was further shown experimentally to be pathogenic to the rabbit, rat, and mouse, but not to the guinea-pig. The author considers it to belong to the genus *Cephalosporium* and names it *C. keratoplasticum* [without a Latin diagnosis]. The conidiophores develop almost perpendicularly to the hyphae; they are simple, septate, mostly 10 to 50 $\mu$ long, and bear heads of ten or more conidia at the tip. The conidia are smooth, hyaline, ovoid or elliptical, continuous or occasionally bicellular, 7·5 to 13 by 3 to 4 $\mu$ in diameter. The intercalary or terminal chlamydospores are hyaline or frequently granulated and measure 3 to 8 $\mu$ in diameter.

Goidànich (G.), Ciferri (R.), & Redaelli (P.). **Identificazione di alcuni lieviti isolati da pasta di legno.** [The identification of some yeasts isolated from wood pulp.]—*Mycopathologia*, ii, 1, pp. 48–51, 1939. [English summary.]

Notes are given on a number of yeasts isolated from stored wood pulp destined for paper-making in Italy [cf. *R.A.M.*, xviii, p. 362], two of which are known to be associated with human diseases, viz., *Mycotorula zeylanoides* [ibid., xvii, p. 39] and *Torulopsis minor* (probably merely saprophytic), while a third is regarded as being probably identical with *Parendomyces albus* Queyrat & Laroche (recorded once, from a vaginal infection), but in view of the incomplete nature of the existing description of this fungus (*Bull. Soc. Méd. Paris*, iii, 28, p. 115, 1909) is named *M. mucinosa* Goid., Cif., & Red., n.sp. ad interim. The fungus has ovate, elliptical, or elongated blastospores, and does not ferment alcohol; it actively assimilates glucose, levulose, maltose, ammonium sulphate, and urea. Other species are identified as *Torulopsis albida*, *Sporobolomyces shibatanus*, and *S. salmonicolor* var. *typicus*.

DIDDENS (H[ARMANNA] A.) & LODDER (J[ACOMINA]). **An appeal for unification of the generic taxonomy in the Mycotoruloideae.**—*Mycopathologia*, ii, 1, pp. 1–6, 1939.

The authors suggest that the Mycotoruloideae should be divided on morphological grounds into the genera *Candida* [*R.A.M.*, xviii, p. 253] and *Trichosporon*. The former is characterized by the presence of a pseudomycelium with or without a true, septate mycelium, blastospores generally arranged characteristically for each species, and the occasional presence of chlamydospores. Of the other possible names for this genus *Syringospora* was used by Quinquaud for a fungus with endospores and is therefore inadmissible, while *Mycotorula* is characterized by blastospores produced either in verticils inserted at the apex of the pseudomycelial cells, or along the pseudomycelium [ibid., xvii, p. 817], and does not correspond with the wider limits proposed for *Candida*. *Trichosporon* is characterized by the presence of a pseudomycelium and a true mycelium with both blastospores and arthrospores; the true mycelium generally prevails and sugars are never fermented. The essential characters, viz., the presence of both blastospores and arthrospores, were unmistakably indicated in Behrend's description of *T. ovoides* and for reasons of priority this name is accepted instead of the more recent synonyms *Proteomyces*, *Oosporidium* [ibid., x, p. 573], and *Geotrichoides* [ibid., xi, p. 477]. The authors regard *Trichosporon* as a transitional genus between *Candida* and *Geotrichum*. The following revised diagnosis is given of the subfamily Mycotoruloideae: pseudomycelium present, and in several species, a true mycelium; blastospores always present, arising from the hyphae in arrangements often typical for each species; chlamydospores or arthrospores sometimes present.

The authors also propose to divide the genus *Candida* into four groups (1) comprising *C. albicans* and many other species, (2) represented chiefly by *C. krusei*, (3) by *C. pelliculosa*, and (4) by *Mycotorula intermedia* and *Brettanomyces* spp.

DIDDENS (H[ARMANNA] A.) & LODDER (J[ACOMINA]). **On some sporogenous yeasts and their imperfect stages.**—*Mycopathologia*, ii, 1, pp. 28–36, 3 figs., 1939.

In a comparative systematic study [which is described] of about 300 supposedly anascosporogenous yeasts nine strains were found to form ascospores with closely related asporogenous strains. The further investigation of these strains demonstrated, *inter alia*, that *Mycocandida pinoysimilis* var. *citelliana* Red. & Cif. is identical with *Saccharomyces fragilis*, and that *Monilia pseudotropicalis* (= *Candida pseudotropicalis*) [*R.A.M.*, xiii, p. 767] is the imperfect stage of *S. fragilis*. *M. macedoniensis* [ibid., xiv, p. 308] (= *Blastodendrion macedoniense*) and its variety *C. macedoniensis* var. *macedoniensoides* should in future be designated *S. macedoniensis* Diddens & Lodder.

REDAELLI (P.), CIFERRI (R.), & CAVALLERO (C.). **Un' ipotesi sull' eterosmosi dei lieviti in rapporto alla dissociazione.** [An hypothesis

concerning heterosmosis in yeasts in relation to dissociation.]—*Mycopathologia*, ii, 1, pp. 12–27, 1939. [English summary.]

From a review of the information at present available on dissociation in the asporogenous yeasts and variability in fungi the authors conclude that dissociation is a case of transitional, reversible, multiple variation in a constant direction: it is not mutation. The population of a cultural clone is composed of individuals with different capabilities (including the ability to produce R and S colonies), and the process that induces dissociation also reduces or even eliminates the activity of one group to the advantage of another. A monogenetic colony may be considered as an 'ecospecies' (in the sense intended by Turesson) including many 'ecotypes'. Thus dissociation in the asporogenous yeasts may be regarded as a cyclogenetic phenomenon.

Experiments with *Mycotorula* [*Candida*] *albicans* [*R.A.M.*, xvii, p. 527], using hypo-, iso-, and hypertonic solutions of saccharose to induce dissociation [ibid., xviii, p. 394] demonstrated marked dissociation of the RS- and R-forms from the S-form, but not of the SR- or S-forms from the R-form. Hence the osmotic power of the yeast cells may be considered as one of the chief factors in dissociation.

From the authors' point of view, the normal S-clone composed only of S-cells is incapable of dissociation; a clone consisting of S-cells and a few R-cells can dissociate into SR- and R-types; a clone of R-type consisting of R- and a few S-cells can dissociate into RS- and S-types; and a clone composed only of R-cells cannot be dissociated.

Vaccari (E.), Baldacci (E.), & Ciferri (R.). **Osservazioni comparative sulle specie del genere Malbranchea.** [Comparative observations on the species of the genus *Malbranchea*.]—*Mycopathologia*, ii, 1, pp. 43–47, 1 pl., 1939. [English summary.]

A comparative study of *Malbranchea pulchella* (1882) [*R.A.M.*, xiii, p. 578], two strains of *M. bolognesii-chiurcoi*, one isolated in 1925 by Bolognesi and Chiurco [ibid., vi, pp. 418, 483] and another by Rivelloni in 1938 [ibid., xvii, p. 242], and *M. kambayashii* [ibid., xiii, p. 578], showed all four to be identical. In spite of superficial analogies with the thallospores (arthrospores) of *Actinomyces* and *Geotrichum*, sporulation in *Malbranchea* ends in the formation of true conidia, through the development of a proconidium which is allied to the same organ in *Sporendonema*.

Niño (F. L.). **Contribución al estudio de las tricopatias piedricas de Venezuela.** [A contribution to the study of the trichopathic 'piedras' of Venezuela.]—*Mycopathologia*, ii, 1, pp. 7–11, 5 pl., 1939. [English summary.]

An account is given of two affections of the hair found in Venezuela, Colombia, Brazil, and the Argentine, both of the 'piedra' type, one forming black nodules and caused by *Piedraia hortai* [*R.A.M.*, xiii, p. 512; xvii, p. 457], and the other, or 'Colombian piedra', with light nodules, caused by *Trichosporum giganteum* [or *P. colombiana* Dodge: ibid., xii, p. 444] and *T. humahuaquensis*. Of the two last-named fungi, the former does not cause hair lesions, while the latter does, but both may possibly be referable to the same taxonomic entity.

NEGRONI (P.) & DE VILLAFAÑE LASTRA (T.). **Micosis generalizada y mortal por Trichosporon proteolyticum n.sp.** [A generalized and fatal mycosis caused by *Trichosporon proteolyticum* n.sp.]—*Mycopathologia*, ii, 1, pp. 52–59, 2 pl., 1939. [English and French summaries.]

From a fatal case of generalized mycosis in the Argentine beginning with a lesion in the lungs simulating tuberculosis, a fungus was isolated which in pure culture on plain, dextrose, or glycerine agar, or carrot, formed woolly or downy, whitish or pure white, zonate colonies, with a smooth, yellowish, or brownish reverse. On wort or honey agar the colonies were round, glabrous, flat, slightly brilliant, zonate, with faintly marked radiating furrows, and a smooth and colourless reverse. Arthrospores were present, and the hyaline, branched, septate mycelium measured 1·5 to 3 $\mu$ in diameter. In culture, the fungus formed nodular organs, appressoria, funicula, and a racquet mycelium measuring 9 $\mu$ in diameter in the thickest parts. The chlamydo-arthrospores measured 3 to 10 $\mu$, or more, by 2·5 to 3 $\mu$. The optimum growth temperature was 37° C. Growth was better on synthetic media containing ammonium sulphate or potassium nitrate as a source of nitrogen than on those containing asparagin. A strong proteolytic action was exerted on wort gelatine, coagulated serum, and milk. The fungus was weakly pathogenic to laboratory animals. It is named *Trichosporon proteoliticum* n.sp. [with a Latin diagnosis].

KESSEL (J. F.). **The coccidioidin skin test.**—*Amer. J. trop. Med.*, xix, 2, pp. 199–204, 1939.

Patients suffering from coccidioidal granuloma, prior to the final fatal stages of the disease, gave positive reactions to injection with a 1 in 10 dilution of a 2 per cent. dextrose veal broth culture of *Coccidioides immitis* [*R.A.M.*, xviii, p. 394] in 22 out of 26 cases, the four unsuccessful attempts being made in the terminal phase. Most of the tuberculous patients similarly treated (191 out of 228) reacted negatively to *C. immitis*; on the other hand, 29 guinea-pigs inoculated with *C. immitis* responded positively to the fungus and negatively to the tubercle bacillus. These data are considered to indicate that the coccidioidin skin test is highly specific in its mode of action, paralleling in many respects the tuberculin test and meriting a similar degree of reliance as an aid to diagnosis.

BARKER (S. G.). **The rot-proofing of textiles.**—*Proc. Food Group, Soc. chem. Ind.*, i, pp. 102–108, 1 fig., 1938.

In this paper the author discusses in detail the differences in the organic chemical nature of various fibres used for the manufacture of textiles with reference to the selection of suitable antiseptics for the prevention of attack by micro-organisms and of rotting in general. It is essential that any treatment applied shall leave the intrinsic characteristics of the fibre unaffected. Shirlan paste and powder have given excellent results in the preservation of the finer textiles. With the coarser textiles, a high lignin content confers strong resistance to attack by micro-organisms, and with these materials the cost of treatment is almost as important as its effectiveness. For economic reasons methods for the

rot-proofing of textiles must be included in current practice rather than applied as a separate treatment. Treatment must not induce increased brittleness or loss of strength.

Brief references are made to the Thaysen acetylation process whereby the surface of cotton is rendered unsuitable as a nutrient for micro-organisms, the use of an iron-chrome proofer in America, the chromium-cutch method, which gives satisfactory results provided the metallic chromium content is maintained between 2·0 and 2·5 per cent. of the weight of the fibres proofed, and the use of creosote, which has the merit of increasing the ability of fibres for saturation with bitumen used for pipe laggings and cable coverings. In selecting an antiseptic each fibre and fabric must be considered individually in relation to the effect that treatment is likely to have.

AKAI (S.). **Studies on the pathological anatomy of the hypertrophied buds of Camellia japonica caused by Exobasidium camelliae.**—*Bot. Mag., Tokyo*, liii, 627, pp. 118–125, 6 figs., 1939. [Japanese, with English summary.]

In this paper the author describes in detail the histological changes produced in hypertrophied buds of *Camellia japonica* by *Exobasidium camelliae* [cf. *R.A.M.*, xiv, p. 532].

DEACON (G. E.). **Notes on a parasitic fungus attacking Rose rust.**—*Rose Annu., 1939*, p. 136, 1 pl., 1939.

*Tuberculina persicina* [*R.A.M.*, v, p. 314] was found on Brog's canina rose leaves at Norwich parasitizing and immobilizing the spores of *Phragmidium mucronatum* [ibid., xviii, p. 184]. The small, white, globular spores of *T. persicina*, arising from somewhat thick sporophores of irregular outline, form a conspicuous white coating over the rust.

MÄHL (A.). **Motorspritze zur Mehltaubekämpfung unter Glas.** [A motor sprayer for mildew control under glass.]—*Blumen- u. PflBau ver. Gartenwelt*, xliii, 12, p. 136, 1 fig., 1939.

Excellent control of rose mildew [*Sphaerotheca pannosa*] under glass is stated to have been obtained in the writer's nursery at Frankfurt-am-Main by the application of the sulphur preparations, erysit, vomasol S [*R.A.M.*, xvii, p. 682], or imprägnit, with the portable motor sprayer Piccolo (Holder-Metzingen).

GIGANTE (R.). **La variegatura del Tulipano** [Tulip breaking.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 4, pp. 429–454, 3 pl., 12 figs., 1938 (issued April, 1939).

In the spring of 1937 the author received from Rome a number of tulip plants affected with full break [*R.A.M.*, xviii, p. 257]. The symptoms [which are fully described] consisted in leaf chlorosis, white spots on red, and yellow spots on violet flowers, irregular leaf development, dwarfing, and flower abortion. The chlorotic areas on the leaves averaged 345 $\mu$ thick, as against an average of 398 $\mu$ for the normal green areas; in the affected areas in the leaves, also, the cells were less developed than in the normal areas, the intercellular spaces were reduced,

and the chloroplasts were either absent or yellowish and irregular. In the affected red flowers the white parts averaged 235 μ thick, and the cuticle 3·6 μ thick, compared with 270 μ and 4·8 μ, respectively, for the normal parts, while the corresponding figures for violet flowers were 226 μ, 3·5 μ (yellow areas), 268 μ, and 4·6 μ. The mesophyll cells of the affected leaves and flowers frequently contained spherical, ellipsoid, or irregular X-bodies measuring 9 to 24 by 6 to 17 μ, often with two vacuoles, and generally in close proximity to the nucleus. In the petals of affected flowers the X-bodies were more numerous in the light than the dark areas. Even in unstained material the epidermal and mesophyll cells of the violet and red areas of the affected flowers showed the presence of deep blue nuclei [loc. cit.].

Transmission was effected by grafting pieces of bulbs from affected plants on to healthy bulbs, by inoculating healthy bulbs with juice from diseased bulbs, and by introducing juice from diseased leaves into the leaves of healthy plants by means of a capillary tube. The symptoms produced consisted in leaf variegation and deformation, dwarfing, and floral abortion; flowers were either not produced at all, or they degenerated with great rapidity. The appearance of the plants resembled that described by Ainsworth for Zimmerman's Triumph tulips infected with cucumber virus 1 [cf. ibid., xviii, p. 182].

Milbrath (J. A.). **Two unusual fungi on ornamental shrubs in the Pacific Northwest.**—*Plant Dis. Reptr*, xxiii, 3, p. 48, 1939. [Mimeographed.]

A fungus isolated from the roots of a plant of *Daphne odora* at Salem, Oregon, was identified in culture by Prof. H. H. Whetzel as *Sclerotium delphinii* [see above, p. 517], stated to occur very rarely on shrubs and trees.

*Boydia insculpta* [*R.A.M.*, i, p. 92], identified by S. M. Zeller, is reported for the first time in America forming large cankers on branches of a holly from the Puget Sound district of Washington. The disease is stated to cause considerable damage to holly hedges and trees. Perithecia were found fruiting on the cankers; the bicellular ascospores, about 100 μ in length, were markedly constricted at the septum.

Gieger (M.) & Barrentine (B. F.). **Isolation of the active principle in Claviceps paspali—a progress report.**—*J. Amer. chem. Soc.*, lxi, 4, pp. 966–967, 1939.

*Claviceps paspali* [*R.A.M.*, xviii, p. 460] was at one time believed to contain the same alkaloids as wheat, or rye, ergot [*C. purpurea*: ibid., xviii, p. 314], but the data resulting from the writers' pharmacological investigations on the fungus at the Mississippi Agricultural Experiment Station entirely disprove this assumption. The therapeutic value of the amorphous compound extracted from ground sclerotia was nil, and the administration to a guinea-pig of 50 mg. of the preparation dissolved in Wesson oil produced the intense trembling characteristic of animals fed on the diseased *Paspalum* grass.

Lefebvre (C. L.). **Ergot of Paspalum.**—*Phytopathology*, xxix, 4, pp. 365–367, 1939.

*Paspalum urvillei* was found naturally infected by *Claviceps paspali*

[see preceding abstract] in Georgia in 1936, 1937, and 1938, and *P. notatum* in the last-named year, when a nursery of 23 species and strains was established at the Arlington Experiment Farm, Virginia, for the purpose of artificial inoculations, which were highly successful on *P. urvillei* (90 per cent.), *P. longipilum*, and *P. laeve*, while positive results were also obtained on *P. dilatatum*, *P. ciliatifolium*, and *P. plicatulum*, the two last named, however, being very resistant. In the greenhouse, infection was readily secured on *P. distichum*, *P. pubiflorum*, *P. floridanum*, and *P. intermedium*. All the species mentioned, except *P. dilatatum*, appear to be new hosts of the ergot fungus, from which *P. notatum* (narrow-leaved Uruguayan and common local strains), *P. lividum*, *P. malacophyllum*, and *P. supinum* remained immune in field trials. The sclerotia of *C. paspali* in the florets of *P. urvillei* were spherical to ellipsoid and measured 1 to 2 by 1 to 1·5 mm. compared with 3 to 4·5 mm. for the irregular, deeply ridged bodies occupying the same organs in *P. dilatatum* and *P. laeve*.

Schander (H.). **Untersuchungen über die Abhängigkeit der Jugendchlorose von Lupinus luteus von Aussenfaktoren in Sandkultur.** [Studies on the dependence of juvenile chlorosis in *Lupinus luteus* on external factors in sand culture.]—*Bodenk. u. PflErnähr.*, N.S., xii, 1–2, pp. 71–84, 1 fig., 8 diags., 2 graphs, 1939.

Continuing his studies on the environmental factors involved in the etiology of juvenile chlorosis of yellow lupins (*Lupinus luteus*) [*R.A.M.*, xviii, p. 257], the writer ascertained by means of sand culture experiments that the occurrence of the condition does not depend on the calcium content of the soil, or directly on the reaction of the latter as a whole, but solely on that prevailing in the vicinity of the root system. A preliminary experiment yielded data suggesting that the root secretions may consist of monopotassium phosphate, in which case they would be liable to precipitation by the presence of appreciable quantities of calcium carbonate in the surrounding medium.

It is evident from a perusal of previous literature on lupin chlorosis that the physiological constitution of older plants is entirely distinct from that of young ones, which alone show the typical symptoms of the lime-induced disorder.

Holz (W.). **Die Bedeutung der Beobachtung des Askosporenfluges von Fusicladium dendriticum für die Terminwahl bei den Vorblütenspritzungen. Vorläufige Mitteilung.** [The importance of the observation of the ascospore flight of *Fusicladium dendriticum* for the timing of pre-blossom spraying dates. Preliminary note.]—*NachrBl. dtsch. PflSchDienst*, xix, 4, pp. 29–31, 1 graph, 1939.

Pursuing his investigations in the Elbe Valley in 1938 on the apple scab (*Fusicladium dendriticum*) [*Venturia inaequalis*] ascospore discharge periods in relation to the timing of pre-blossom sprays for the control of the disease [*R.A.M.*, xviii, p. 462], the writer emphasizes the great importance of applying the prophylactic treatment before the main flight. In the experiments herein described the pre-blossom spray of 24th March (2 per cent. Bordeaux mixture) resulted in a yield of

51·1 per cent. sound fruits, whereas the 2 per cent. lime-sulphur application postponed until 24th April (after the close of the flight from 15th to 20th) produced only 15. The highest output (90·2 per cent.) of healthy apples was secured by four treatments (two pre- and two post-blossom), while the unsprayed controls yielded only 7·2 per cent.

Holz (W.). **Der Einfluss der März-Temperaturen auf die Geschwindigkeit des Reifungsvorganges von Venturia inaequalis-Perithezien.** [The influence of March temperatures on the rapidity of ripening of the perithecia of *Venturia inaequalis*].—*Angew. Bot.*, xxi, 2, pp. 209–214, 1 graph, 1939.

The author points out that in the control of *Venturia inaequalis* [see preceding abstract] it is of the utmost importance to apply the first spray before the beginning of ascospore discharge, the prediction of the probable date of which is therefore essential. From observations in Altenland (Lower Elbe), Germany, carried out over a period of seven years (1932 to 1938), the author found the average dates on which the perithecia ripened. Temperature aggregates, based on mean daily temperatures, were calculated for each year from the 1st or 15th of each month between November and April to the date of the ripening of the perithecia. It appeared that the temperatures before 1st March had no appreciable effect on the ripening of perithecia. From that date onwards until the perithecia ripened the mean day temperature aggregates were almost constant during the seven years, being on the average 105° C., whereas the temperature aggregates from earlier or later dates differed considerably in the various years. It is concluded that the sooner a mean day temperature aggregate of 105° is reached after 1st March, the sooner the perithecia will ripen. These results being admittedly valid only for the district under observation, it is suggested that similar calculations should be made for other fruit-growing areas.

McKay (R.). **Further spraying experiments for the control of Apple scab in 1937 and 1938, with some observations on the disease.**—*J. Dep. Agric. Éire*, xxxvi, 1, pp. 42–72, 11 figs., 1 diag., 1939.

In further spraying experiments against apple scab (*Venturia inaequalis*) in Éire [*R.A.M.*, xvii, p. 533] satisfactory control was obtained in 1937 and 1938 by three or four pre- and post-blossom applications of lime-sulphur or Bordeaux mixture, the latter being the better fungicide and giving more lasting protection to the foliage and fruit. Some injury to the foliage and russeting of the fruit was, however, observed on all trees sprayed with Bordeaux mixture. The disease was more easily controlled on trees sprayed regularly than on those untreated for several years, but thorough spraying effectively controlled the disease even when infected bud scales were present. It was found that wherever scab was prevalent on apple trees during the growing season infected bud scales were present during the following dormant season, providing conidia for initial infection of the foliage in the spring. The absence of infected buds in 1937 was equivalent in its controlling effect to three or four sprays. Tar oil washes applied during the dormant season had no effect on the control of the disease.

Petch (C. E.). **Evaluating orchard spray materials—a progress report.**—*Sci. Agric.*, xix, 7, pp. 424–434, 1939.

To determine whether it may be possible to estimate more exactly the true value of a fungicidal spray than is the case when only the reduction in the percentage of affected fruits is considered, the author carried out comparative spraying tests in Quebec from 1934 to 1937 on McIntosh apple trees, using lime-sulphur and calcium arsenate and other materials as applied under commercial conditions, and carefully observing the effects produced in relation to scab (*Venturia inaequalis*), russeting, end-burn, insect pests, windfalls, number of apples borne, weight of the harvested crop, trunk girth, terminal growth, bud size, and ash content of the foliage. The data obtained [which are tabulated] indicated that an increased yield may be correlated with increase in bud size, twig growth, and ash content of the leaves, and that differences in these may be due to the use of different fungicides. The materials employed in spraying should protect the tree and the fruit against disease while at the same time exerting no phytocidal action. In the author's opinion, the best criterion of the value of a spray is the weight of clean, marketable fruit given by the trees treated with it. The author's data and other experimental results show that in estimating the value of spray materials their effect on tree growth, foliage development, and total crop production should be considered, as well as the protection afforded to the fruit.

Boyd (O. C.). **Northwestern anthracnose of Apple reported from Massachusetts.**—*Plant Dis. Reptr*, xxiii, 7, pp. 125–126, 1939. [Mimeographed.]

In March, 1939, typical infections of north-western anthracnose (*Neofabraea malicorticis*), showing the 'guitar-string' fibres stretched across the old canker areas, were observed on inadequately sprayed Cortland and McIntosh apple trees [*R.A.M.*, xvii, p. 797] in Plymouth County, Massachusetts, this being apparently the first record of the disease for the State. The most severe damage arose from the 1937 cankers, those of 1938 being generally noticeable only as extensions of the previous season's infections.

Fresa (R.). **La presencia de 'Entomosporium maculatum', parásito del Manzano, en el Delta de Paraná.** [The presence of *Entomosporium maculatum*, a parasite of the Apple, in the Paraná Delta.] —*Rev. argent. Agron.*, vi, 1, pp. 53–56, 3 figs., 1939.

Attention is drawn to the detection, in December, 1937, of *Entomosporium maculatum* [the imperfect stage of *Fabraea maculata*: *R.A.M.*, xviii, p. 478], forming reddish, later dark chestnut, concentric lesions, 1·5 to 3 mm. in diameter, on apple foliage, this being the first record of the fungus on the host in question in the Argentine, where it has previously been reported, however, on pear and quince. The attack occurred on five- to seven-year-old apple trees, the Araucano variety being the most severely affected.

Miller (P. R.). **Incidence and importance of Quince rust on Apple as affected by environmental and developmental factors.**—*Plant Dis. Reptr*, xxiii, 5, pp. 80–82, 1 map, 1939. [Mimeographed.]

Four years' observations in Maryland, Virginia, West Virginia, North

Carolina, Georgia, and Pennsylvania showed that quince rust (*Gymnosporangium clavipes*) [*R.A.M.*, xvii, p. 400] has long been present in this area on members of the Rosaceae and species of *Juniperus*. Once established on the juniper this rust is perennial and may sporulate for twenty years. On apple, infection is confined to the fruits, which are susceptible only during a period of about twelve days, while small. The basidiospores are disseminated during a relatively short period, as compared with those of *J. juniperi-virginianae* [ibid., xviii, p. 321] and *G. globosum* [ibid., xvi, pp. 542, 618]. Apples do not become infected by *G. clavipes* unless the susceptible stage of development coincides both with basidiospore dissemination and a rainy spell. These limiting factors have probably checked the disease, which attains economic importance only when all these factors are favourable.

Scupin (Frl. L.). **Frischhaltung von Äpfeln mit Hilfe bestimmter Öle.** [Apple preservation with the aid of certain oils.]—*Obst- u. Gemüseb.*, lxxxv, 4, pp. 48–49, 1 fig., 1939.

Particulars are given of experiments at the Magdeburg (Germany) Co-operative Low Temperature Research Station on the treatment of Landsberg Renette and Beauty of Boskoop apples immediately after harvesting with three brands of oil (2252, 2253, and 2243) supplied by the firm Rhenania-Ossag, of which the last named caused injury to the fruit. After three, four, five, and six months storage (1937–8) at +1° C. the incidence of *Gloeosporium album* [*R.A.M.*, xvi, p. 820; xviii, p. 119] in the lots of Landsberg Renette treated with 2252 was 40, 62, 68, and 74 per cent., respectively, compared with 28, 46, 64, and 76 for 2253 and 52, 64, 70, and 72 for the controls. The corresponding figures for the same variety at −1° were as follows: 2252, 18, 42, 52, and 63 per cent., respectively; 2253, 18, 40, 51, and 52; and controls, 37, 53, 60, and 64. For Beauty of Boskoop at +1° the incidence of infection in the 2252-treated lots after the same periods was 0, 2, 4, and 4 per cent., respectively, compared with 0, 2, 8, and 10 for 2253 and 0, 6, 16, and 54 for the controls. The corresponding figures for the same variety at −1° were as follows: 2252, 0, 2, 4, and 8 per cent., respectively; 2253, 0, 0, 4, and 7; and controls, 0, 2, 11, and 43.

Hewitt (W. B.) & Leach (L. D.). **Brown-rot Sclerotinias occurring in California and their distribution on stone fruits.**—*Phytopathology*, xxix, 4, pp. 337–351, 3 figs., 1 map, 1939.

In addition to information already presented in a preliminary note [*R.A.M.*, xviii, p. 120], this expanded account of the writers' studies on the species of *Sclerotinia* concerned in the brown rot of stone fruits in California contains the following items of interest. *S. laxa* [ibid., xviii, p. 461] is believed to have been long present in the State and responsible for most of the infection described as brown rot in previous publications. It was widely distributed throughout the area surveyed (comprising the principal fruit-growing districts), whereas *S. fructicola*, which is probably of comparatively recent introduction, was more localized, occurring most abundantly in the Sacramento Valley. Both species have been isolated from blighted blossoms and twigs of peach, nectarine, apricot, and cherry, but *S. laxa* alone appears to attack almonds. In general,

*S. laxa* shows a preference for blossoms and twigs, whereas *S. fructicola* is mainly restricted to the fruits. In the San Joaquin valley most of the cultures of *S. fructicola* were derived from peach and nectarine, while almond and plum yielded *S. laxa*, which was also the only species developing from overwintered blighted stone fruit twigs producing 'sporodochia'.

Leach (L. D.) & Hewitt (W. B.). **Forced ejection of ascospores from apothecia of Sclerotinia species.**—*Phytopathology*, xxix, 4, p. 373, 1939.

The exposure of mature apothecia of *Sclerotinia sclerotiorum* and the brown rot fungi [*S. fructicola* and *S. laxa*: see preceding abstract], after two days in a moist chamber at 4° C., to the vapours exhaled by an aqueous solution of alcohol (41·7 per cent. by vol.), formalin (14·3), and acetic acid (14·3), was found to induce violent and repeated ascospore discharge. The vapours of alcohol alone and of alcohol and acetic acid exerted no appreciable effect, but formalin alone acted similarly to the combined fixative. A large percentage of the spores thus ejected proved capable of germination.

Buckstеeg (W.). **Untersuchungen über den Sporenflug bei Monilia als Grundlage für die chemische Bekämpfung. Vorläufige Mitteilung.** [Researches on the aerial distribution of *Monilia* spores as a basis for chemical control. Preliminary report.]—*Z. PflKrankh.*, xlix, 4, pp. 252–258, 2 graphs, 1939.

Spores of *Monilia* [*Sclerotinia* spp.: *R.A.M.*, xviii, p. 401] were found to be present in the air of two cherry orchards and one of pome fruits in the Lower Elbe district of Germany throughout the year. From the middle of August to the beginning of October only few spores were found, while great numbers were present from October to the beginning of December, again in April, and from the second half of May to early June. When mummified fruits were exposed, spores were produced freely on those left on the ground during rainy and warm days, whereas no spores were found on those stored in a dry and cool room; and while spores were formed on some of the fruits hung in bags on the tree, none developed on those covered by 2 to 3 cm. of soil, indicating that high temperature, humidity, and free ventilation are important factors in spore formation. Consequently the danger of infection is particularly great during the first warm days in spring. It is recommended, therefore, that a first spray should be applied when the buds begin to swell and a second just before the blossoms open, while a third and fourth should follow directly after petal fall, and two to three weeks after flowering, respectively.

Husz (B.). **Hazai adatok a csonthéjas gyümölesfák gombaokozta levélfoltosságaihoz. I.** [Data on the shot hole disease of stone fruit trees. I.]—*Bull. R. Hung. hort. Coll.*, v, pp. 23–39, 1 col. pl., 2 figs., 1939. [English summary.]

On account of its olive-green to brownish spores the fungus *Phyllosticta prunicola* [renamed *Phoma prunicola* by Wollenweber and Hochapfel: *R.A.M.*, xviii, p. 464] is transferred to *Coniothyrium* as *C.*

*prunicolum* [n. comb.]. It is the agent in Hungary of shot hole of apricot leaves and spotting of the fruits (small, greyish-white, brown-edged lesions), produces concentric spots with alternate brown and carmine-red zones on sweet cherry fruits, and also attacks the foliage of sweet and sour cherries, prunes, and almonds, this being the first record for Europe of *C. prunicolum* on the leaves of the last-named host. The pycnidia of the fungus measure 70 to 110 or up to 170 $\mu$ when provided with one pore, 260 by 220 $\mu$ when two to four are present, as in material examined from the almond, and the elliptical to ovate, rarely spherical conidia 3·6 to 8 by 2 to 3·6 (or up to 4·5) $\mu$.

Particulars are given of a comparative study of *C. prunicolum* and *Clasterosporium carpophilum* (well known in Hungary on sweet and sour cherries, prunes, apricots, peaches, and almonds) in prune agar cultures.

The occurrence of *Phyllosticta beijerinckii* on apricot leaves is reported.

Willison (R. S.). **Brown rot of Peaches in transit and storage.**—*Sci. Agric.*, xix, 7, pp. 458–474, 6 graphs, 1939.

In experiments carried out in Ontario, Rochester and Elberta peaches from trees to which different fungicidal spray and dust treatments had been given were picked in the green, intermediate, and ripe stages, wrapped in tissue paper, packed in two-layer lugs, and dispatched in refrigerated trucks at temperatures of 45° to 50° F. to Winnipeg and Saskatoon (1,000 and 1,500 miles, respectively), other lots being sent to England via Montreal. The fruits were examined on arrival at their destination and at subsequent intervals, and duplicate lots were examined at corresponding times in Ontario.

While peaches picked in the riper stages were more susceptible to the development of brown rot (*Sclerotinia fructicola*) [*R.A.M.*, xviii, p. 190] than those picked in the green stage, the evidence showed that the use of suitable fungicides, combined with careful handling and storage at a suitable temperature, delayed the onset of the disease long enough to permit the shipping and marketing of fruits picked at a sufficiently ripe stage to be of good quality when sold. Later pickings were rather more susceptible to *S. fructicola* than fruits picked on earlier dates. While no treatment gave complete control, wettable sulphur sprays applied immediately before harvest gave more uniform results than those which had to be applied two or three weeks earlier. Sulphur dusting gave satisfactory control except when rain intervened between treatment and harvesting. The incidence of bruising, and of rots (due to *Rhizopus nigricans* and *Penicillium*, *Cladosporium*, and *Alternaria* spp.), was reduced by careful handling. When the packs were exposed to low temperatures within eight hours of picking, little or no rot developed until they were returned to higher temperatures, but when they were kept for an additional 24 hours before being cooled, brown rot was about as prevalent as in the lots not cooled at all. When the truck was iced only on departure, and not subsequently, the peaches from sprayed and dusted trees showed about as much brown rot as those from untreated trees.

DAXER (H.). **Versuche über die Wirkung des Kupfers auf Blätter.** [Experiments on the effect of copper on leaves.]—*Z.PflKrankh.*, xlix, 4, pp. 225–251, 10 figs., 1939.

In experiments with stone and pome fruits and berries in 1937–8 at Geisenheim, Germany, leaves were totally immersed for varying periods in copper solutions contained in waxed paper bags. When four neighbouring leaves of a potted peach tree were treated thus for 48 hours in a 0·35 per cent. solution of copper sulphate, several leaves and branches 20 to 40 cm. away from the enclosed leaves showed the presence of copper; in a similar experiment with a potted pear tree the presence of copper was established at distances of 1, 20, and 65 cm. from the treated leaves. These results show that the copper is absorbed by the leaf and conducted along the vessels. Injury was found to increase with temperature (small spots appearing at 5° C., marginal burns at 25°, and damage to almost the entire leaf at 34°), and was also more severe in wounded leaves than in unwounded. Copper solutions from 0·62 to 0·006 per cent. caused after a few hours or several days severe discoloration and eventual fall of treated leaves, and wilting and discoloration of leaves up to 1 m. from the bag, the injury spreading farther towards the tips of the branch than towards the bases. Sometimes the bark at the base of the enclosed leaf was also discoloured, torn, and sunken. Copper solutions of 0·003 to 0·0006 per cent. still damaged the enclosed leaves, but no injury was caused by solutions of 0·00025 per cent. The Silvan vine variety was more resistant to copper injury than the Le Lectier pear, the Grosse Lange Lot cherry being the least resistant. Copper solutions of 0·5 per cent. caused injury in one to two hours, while weaker solutions needed longer, 0·00125 per cent. being too weak to cause any injury at all in 24 hours. Since high concentrations of copper occur in the spray film, if at all, only for a few minutes before it dries up completely, it is concluded that copper injury to fruit trees would not result from normal spraying, except possibly in districts with much dew and fog.

The application of a leaf stalk injection method showed that 0·13 to 0·64 mg. of metallic copper caused severe injury to all fruit trees; 0·05 to 0·1 mg. caused moderately severe to severe injury to stone fruits but only slight injury to pomes; 0·025 mg. caused slight injury to stone fruits and scarcely any to pomes. It is suggested that the different degrees of resistance of stone and pome fruits to copper is based on differences in cell structure.

HILDEBRAND (E. M.). **Currant mosaic.**—*Phytopathology*, xxix, 4, pp. 369–371, 1 fig., 1939.

During the past four years a mosaic-like disease of red currants, typified by partial foliar chlorosis (sometimes unilateral), stunting, and gradual loss of productivity, has spread rapidly in a commercial planting in Ulster County, New York. Successful transmission of infection from diseased to healthy shoots was secured in three out of five inarch-grafting experiments, but budding and whip-grafting trials gave negative results. Cuttings from diseased plants failed in propagation tests, denoting a decline in vitality. Natural spread is presumably effected by insects, the identity of which has not yet been determined.

Blackford (F. W.). **Virus diseases of the Strawberry.**—*Qd agric. J.*, li, 2, pp. 173–176, 1 fig., 1939.

Strawberries in Queensland are affected both by yellow edge and crinkle [*R.A.M.*, xviii, p. 402]; the former condition is more prevalent than the latter, though in one planting crinkle was so severe on an introduced variety that the plants were a complete loss. The most important varieties grown in Queensland, Phenomenal and Aurie, appear to be susceptible to both diseases, but it is thought that they can be controlled by roguing the diseased mother plants from the runner beds, the operation being commenced in winter. In Southern Queensland the symptoms of yellow edge and crinkle are much more pronounced in the cooler months than in the warmer ones, while at temperatures over 80° F. the symptoms of yellow edge became masked.

Beattie (R. K.) & Crandall (B. S.). **Disease attacks the Persimmon.**—*Amer. Forests*, xlv, 3, pp. 120–121, 124, 5 figs., 1939.

A semi-popular account is given of the *Cephalosporium* wilt of American persimmons (*Diospyros virginiana*), originating in Tennessee and shown by surveys in 1937 and 1938 to have spread to Mississippi, Alabama, Georgia, South Carolina, and Florida [*R.A.M.*, xvii, p. 539]. Preliminary inoculation experiments denote that *D. kaki*, grafted on *D. virginiana*, is also liable to contract the disease, and the fungus has further been shown to be pathogenic to *D. lotus*. Wilted trees are subject to rapid secondary infection by *Schizophyllum commune*, causing collapse within a few months. The possibilities of control by selection and hybridization are discussed. [An account of this work is also given by B. S. Crandall in *Plant Dis. Reptr*, xxiii, 4, pp. 56–58, 1 map, 1939.]

Pesante (A.). **Sopra una malattia dell' Olivo sino ad ora sconosciuta.** [On a hitherto unknown disease of Olive.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 4, pp. 401–428, 2 col. pl., 17 figs., 1938 (issued April, 1939).

During the past few years olives in various parts of Italy have been affected by an apparently new form of branch withering and defoliation. Affected trees, showing bronzing of the foliage and defoliation at the extremities of the branches, occur in sparse groups among trees at first sight unaffected, but which closer inspection shows have already contracted the condition. In these more slightly affected trees a few leaves on the terminal twigs of one or two branches, or some of the leaves of a few suckers on the larger branches, are abnormally bright green and transparent in the terminal part, this area being distinctly separated from the normal distal part. The veins in the affected region are brown. In the more advanced stage, the leaf structure shows marked change, partial defoliation has taken place, and there is extensive leptonecrosis of the branches and frequently of the leaf veins. The affected leaves are thick, rigid, brittle, and light green to bronze or deep brown. Affected leaves or parts of leaves contain abnormally large amounts of starch. If a diseased branch is lightly shaken, the leaves sometimes readily fall. At this stage, the terminal part of the branch is bare, the middle shows affected leaves, and the proximal part carries apparently normal leaves. Gradually, the entire foliage becomes

involved; progressive necrosis of the cambium and phloem sets in, and trees so affected do not recover. Productivity is reduced, as the buds on the axils of the diseased leaves generally die; if they survive, the fruits are much dwarfed.

No parasitic organism or soil defect appeared to be associated with the condition, which, from the nature of the symptoms, would seem to be of virus origin.

[A condensed account of this work appears in *R.C. Accad. Lincei*, Ser. VI, xxix, 1, pp. 37–39, 1939.]

KEARNS (H. G. H.) & MARTIN (H.). **The position of combined washes in the post-dormant spray programme. Part I. The physical properties of spray-fluids with special reference to post-dormant washes. Part II. The use of post-dormant combined washes in fruit crops.**—*Sci. Hort.*, vii, pp. 96–118, 1939.

In the first part of this paper the authors discuss the physical properties of spray fluids with special reference to the influence of spray supplements (wetters, spreaders, and penetrants) on retention of the spray by the sprayed surface, on the tenacity of the spray deposit, and on penetration. The methods by which sprays can be rendered suitable for over-spraying without serious loss of protective qualities or increase in phytocidal action are indicated, and it is shown that oil emulsions furnish the best basis for combined direct and protective insecticidal-fungicidal sprays, as they have, combined with insecticidal or fungicidal properties, good powers of penetration and wetting, with high retention and tenacity.

In the second part, notes are given on the chief materials used in post-dormant insecticidal-fungicidal washes, including copper- and rotenone-containing products, petroleum oil emulsions, ferrous sulphate, and water-soluble spreaders, and spray programmes are indicated for apples, plums, currants, and strawberries.

HEUBERGER (J. W.) & HORSFALL (J. G.). **Relation of particle size and color to fungicidal and protective value of cuprous oxides.**—*Phytopathology*, xxix, 4, pp. 303–321, 1 graph, 1939.

In this study on the relation of particle size and colour to the fungicidal and seed- and foliage-protective values of cuprous oxide [*R.A.M.*, xviii, p. 332], particle size was measured by an adaptation of Wilcoxon and McCallan's technique, based on microscopic counts of the number of particles lying within a known area and a calculation of their weight from the concentration of material in the liquid and the volume of liquid for each square [ibid., xi, p. 386]. Fungicidal value (capacity for the inhibition of spore germination) was gauged by a modification of the same workers' slide-testing technique [ibid., xi, p. 730], using a precision sprayer depositing 0·000384 mg. of a 0·1 per cent. copper solution per sq. cm. per second on the cellulose nitrate-coated slides, the test fungus being a 21-day-old potato dextrose agar culture of *Macrosporium* [*Stemphylium*] *sarcinaeforme* [ibid., xviii, p. 141]. The protective value (ability to prevent plant tissue infection) of the various brands of cuprous oxide was tested against damping-off (mainly

*Pythium ultimum*) on Perfection pea seeds, definite amounts of the different samples being added to 100 gm. seed in Erlenmeyer flasks, which were rotated for ten minutes at 40 r.p.m.; the seed was then planted in soils of high damping-off inoculum potential [ibid., xviii, p. 332] in the greenhouse, climate laboratory (Johnson chambers) [ibid., vii, p. 531], and field. This factor was further measured in the field on rose and tomato foliage infected, respectively, by *Diplocarpon rosae* and *Alternaria solani*, using standard spraying methods.

The colour of cuprous oxide was found to be a function of the particle size, the normal range extending from acajou red at 2·57 $\mu$ mean diameter through orange Pompeian red (1·65 $\mu$) to Mars yellow at 0·94 $\mu$. The presence of black cupric oxide imparts a dark shade. The mean particle diameter of thermal cuprous oxide ranges up to 2·93 $\mu$. The fungicidal and protective values of the cuprous oxide varied inversely with particle size, increasing with the graduation of the tone from red through orange to yellow. The apparent reduction of fungicidal and protective efficacy by the presence of cupric oxide in the preparations is thought to be due to the tendency of the compound to increase particle size and to the dilution of the cuprous oxide.

The probable explanation of the enhanced fungicidal and protective values of cuprous oxide of small particle size lies in the increase both in the area of chemically reactive surface per unit of weight and in the rate at which copper is presented to the germinating spore.

In connexion with the significance of laboratory tests in research on fungicides, it is of interest that the various brands of cuprous oxide occupied the same relation to each other in the field and greenhouse as in the laboratory trials, the yellow being much more effective than the red against the diseases under investigation.

ROACH (W. A.). **Plant injection for diagnostic and curative purposes.**—*Tech. Commun. Bur. Hort. Plant. Crops, E. Malling*, 10, 78 pp., 46 figs., 1 graph, 1938. [Received June, 1939.] 5*s.* 0*d.*

In this monograph, work on plant injection in various countries is critically surveyed, and the different methods of injection with liquids, based on the author's own work, are described. The main purpose of these methods is stated to be the diagnosis of mineral deficiencies.

WARNES (A. R.). **Building materials. Their discoloration, decay, cleaning and reparation.**—*J. Clerk Wks Ass.*, lv, 666, pp. 154–157, 1938. [Abs. in *Build. Sci. Abstr.*, N.S., xi, 11, pp. 354–355, 1938.]

Recent researches appear to have thrown doubt on the theory that soot is the primary cause of discoloration of building materials, such as stone, brick, terra-cotta, and cement renderings [*R.A.M.*, xviii, p. 333]. An analysis of the soot from the main cornice of a large London building revealed, in addition to dust from miscellaneous sources, moulds and other types of micro-organisms. The water-soluble substances from this material produce yellow to reddish-brown stains on stone and brickwork. The incidence of decay of this nature may be considerably reduced by the use of pure water for washing instead of chemicals, such as caustic soda. Careful steam cleaning may also be utilized.

Quanjer (H. M.). **Nieuwe inzichten in den aard der voor planten pathogene viren.** [New glimpses into the nature of the phytopathogenic viruses.]—*Tijdschr. PlZiekt.*, xlv, 2, pp. 42–51, 1939.

A summary is given of some recent important contributions to the understanding of plant viruses, reference to all of which has been made from time to time in this *Review*.

Black (L. M.). **Inhibition of virus activity by insect juices.**—*Phytopathology*, xxix, 4, pp. 321–327, 5 graphs, 1939.

Juices of the insect vectors *Aceratagallia sanguinolenta*, *Aedes aegypti*, *Aphis rumicis*, *Eutettix tenellus*, *Macrosiphum pisi*, *M. solanifolii*, *Macrosteles divisus*, and *Myzus persicae* at a strength of 15·5 mg. per c.c. were experimentally shown by the half-leaf inoculation method to inhibit the infectivity of tobacco mosaic virus solution to Early Golden Cluster beans (*Phaseolus vulgaris*). Juices of macerated *Aceratagallia sanguinolenta* further inhibited the infectivity of plant juices containing the viruses of potato yellow dwarf [*R.A.M.*, xviii, p. 270], tobacco mosaic, turnip mosaic [ibid., xviii, p. 223], tobacco necrosis [ibid., xviii, pp. 348, 416], tobacco ring spot No. 1, and potato virus X, in inoculations on appropriate test plants with mixtures of insect juice and virus.

It was found that the infectivity of certain mixtures of tobacco mosaic virus and *A. sanguinolenta* juice can be increased by dilution or heat treatment. The inhibitor in the juice of this insect is thermolabile, dialysable only with difficulty, and unstable in acid or alkaline solution. If, as seems probable, the inhibitor is a protein, its activity is remarkable since 0·15 mg. of *A. sanguinolenta* juice, containing only about 0·0015 mg. soluble protein nitrogen, reduces the infectivity of 1 c.c. of a solution of tobacco mosaic virus by 50 per cent. The number of primary lesions in beans was reduced by an approximately constant percentage by a given concentration of the inhibitor in the presence of different concentrations of the tobacco mosaic virus. The latter, however, is not destroyed by the inhibitor, the separation of which from the infective principle in mixtures can be effected either by ultracentrifugation or ultrafiltration.

Bawden (F. C.) & Pirie (N. W.). **Plant viruses I: serological, chemical and physico-chemical properties.**—*Tabul. biol., Den Haag*, xvi, 4, pp. 355–371, 4 graphs, 1938.

Tables are presented showing the properties of plant viruses in crude infective sap, their serological reactions, activity of purified virus preparations, approximate weights of virus in 1 l. sap, analytical composition, precipitation and isoelectric points, inactivation by acid and alkali ($P_H$ stability ranges), effect of enzymes, shape of virus particles, sedimentation constants, viscosity, specific volume and specific gravity, and ultra-violet absorption spectra of solutions of purified plant viruses.

Smith (K. M.). **Plant viruses II: virus diseases of plants.**—*Tabul. biol., Den Haag*, xvii, 1, pp. 25–71, 1939.

This is a synopsis in tabular form of the modes of transmission, insect vectors, differential hosts, principal symptoms on main hosts, distribution, control, and literary records of some 150 virus diseases of plants.

Moriyama (H.) & Ohashi (S.). **Minute body-forming protein of vegetable origin and its relation to viruses.**—*J. Shanghai sci. Inst.*, Sect. iv, 4, pp. 17–38, 1938. [Abs. in *Chem. Abstr.*, xxxiii, 11, p. 4288, 1939.]

Minute body-forming protein was obtained from normal cucumber, kidney bean [*Phaseolus vulgaris*], tomato, poplar, spindle tree [*Euonymus europaeus*], *Taraxacum officinale*, lettuce, and eggplant leaves, and from the petals of normal bindweed [*Convolvulus arvensis*] flowers by the method described in previous issues of the same publication for the isolation of vaccinia virus and phage protein. The minute bodies of the vaccinia virus protein are defined by the first-named author in *J. Shanghai sci. Inst.*, Sect. iv, 3, pp. 135–140, 1937 as (at $P_H$ 7·4) 'micelles observable under an ultramicroscope' and (at $P_H$ 5·4) as 'particles so large as to be observable under an ordinary microscope and unable to pass through a Berkefeld V filter, but definitely smaller than staphylococci'.

Endrigkeit (A.). **Das ernährungsphysiologische Problem der Mykorrhiza.** [The nutritional-physiological problem of the mycorrhiza]. —*Umschau*, xliii, 12, pp. 272–275, 9 figs., 1939.

The writer here concisely summarizes the results of his colorimetric studies on the nutritional and physiological interrelationships of mycorrhiza and their hosts in Germany, a more detailed account of which has already been presented from another source [*R.A.M.*, xvii, p. 407].

Romell (L. G.). **The ecological problem of mycotrophy.**—*Ecology*, xx, 2, pp. 163–167, 1 fig., 1939.

In discussing the nature of the symbiotic relation between conifers and their mycorrhizal fungi, the conclusion is drawn from the author's and other workers' observations that the obligate mycorrhizal fungi of conifers are unable to obtain adequate nitrogenous food from decomposing organic matter in the soil, but that they are vigorous parasites on their host trees. On the other hand, conifers are known to develop poorly in the absence of mycorrhizal fungi. It is believed that the hyphae of the mycorrhizal fungi serve the host tree by forming a highly efficient absorbing system, which requires less expenditure in assimilates on the part of the tree than a correspondingly efficient root system would have done, while the tree supplies the fungi with a source of energy particularly easily utilized.

Modess (O.). **Experimentelle Untersuchungen über Hymenomyceten und Gasteromyceten als Mycorrhizabildner bei Kiefer und Fichte. (Vorläufige Mitteilung).** [Experimental studies on Hymenomycetes and Gasteromycetes as mycorrhiza-producers on Pine and Spruce. (Preliminary note).]—*Svensk bot. Tidskr.*, xxxiii, 1, pp. 91–93, 1939.

In the writer's experiments at the Botanical Laboratory, Upsala, Sweden, on mycorrhizal synthesis between about 50 Hymeno- and Gasteromycetes and pine (*Pinus sylvestris* and *P. montana*) and spruce (*Picea abies*) seedlings in pure culture, using Melin's technique [*R.A.M.*, v, p. 245; xvi, p. 49], mycorrhiza were formed by *Amanita mappa* on all

three hosts, *A. muscaria umbrina* on all, *A. pantherina* on all, *A. rubescens* on *Pinus montana*, *Boletus flavidus* on all, *B. subtomentosus* on *P. montana*, *Clitopilus prunulus* and *Entoloma rhodopolium* on *P. sylvestris*, *Lactarius helvus* on all, *L. rufus* on *P. montana*, *Tricholoma albobrunneum*, *T. imbricatum*, and *T. pessundatum* on all, *T. vaccinum* and *Rhizopogon luteolus* on *P. sylvestris*, and *R. roseolus* on *P. sylvestris* and *P. montana*.

Melin (E.) & Lindeberg (G.). **Über den Einfluss von Aneurin und Biotin auf das Wachstum einiger Mykorrhizenpilze. Vorläufige Mitteilung.** [On the influence of aneurin and biotin on the growth of some mycorrhizal fungi. Preliminary note.]—*Bot. Notiser, 1939*, pp. 241–245, 1939.

Details are given of a series of preliminary experiments at Upsala, Sweden, in which the authors, following Fries's technique [*R.A.M.*, xviii, p. 335], tested the influence on the development of seven mycorrhizal fungi of aneurin, yeast filtrate, biotin, and inosit, added in appropriate concentrations to a synthetic (glucose-containing) medium at 25° C. The organisms responded by increased growth to the admixture of 1 $\gamma$ aneurin or 1 mg. yeast filtrate with the culture solution, the excess of dry weight over the controls being in most cases substantial; thus after 25 days the weights of *Boletus elegans* [ibid., v, p. 246], *Clitopilus prunulus* [see preceding abstract], and *Rhizopogon roseolus*, stimulated with aneurin were about 10·6, 18, and 28·3 mg., respectively, compared with 1·5, 1, and 1·3 for the controls, the corresponding figures for yeast being 15·6, 15·5, and 31·4 mg., respectively. *Tricholoma albobrunneum* and *T. imbricatum* [loc. cit.] reacted more favourably to the yeast than to aneurin, producing 11·9 and 18·5 mg. dry weight, respectively, compared with 1·9 and 2·1 for the controls. Biotin (0·05 $\gamma$) and inosit (1 mg.), alone or jointly, failed to improve the growth of any of the fungi used in the tests, but in combination with aneurin both exerted a beneficial effect, the dry weights of *R. roseolus*, for instance, after 20 days being 16·4, 22·7, and 17·1 mg., respectively, for aneurin and biotin, aneurin and inosit, and all three together, compared with 11·2 for aneurin alone and 0·7 for the control.

Robbins (W. J.) & Schmidt (Mary B.). **Preliminary experiments on biotin.**—*Bull. Torrey bot. Cl.*, lxvi, 3, pp. 139–150, 1 graph, 1939.

The authors describe a method of estimating the biotin content of various substances [cf. *R.A.M.*, xviii, p. 268] by using as an indicator *Nematospora gossypii*, shown by Kögl and Fries to be unable to grow in the absence of small amounts of an accessory factor of the bios type [see preceding abstract]. The technique is based on data from the experiments of the above-mentioned workers. *Lophodermium pinastri*, another fungus with similar biotin requirements, was also used in some of the tests.

Vandendries (R.). **Les multiples aspects de la sexualité dans le monde des champignons.** [The manifold aspects of sexuality in the realm of fungi.]—*Bull. Acad. Belg. Cl. Sci.*, Sér. 5, xxiv, 12, pp. 842–856, 1938.

This is a survey of the outstanding contributions to the knowledge

of the sex relationships of the Basidiomycetes appearing during the last twenty years. Reference has been made from time to time in this *Review* to those of the studies with a bearing on matters of phytopathological interest.

BALDACCI (E.). **Prime richerche di immunizzazione di organi isolati e tessuti vegetali in vitro. I. II.** [First researches on the immunization of detached organs and plant tissues *in vitro*. I. II.]—*Boll. Soc. ital. Biol. sper.*, xiv, 1, pp. 50–51, 1939.

Continuing his studies on plant 'vaccination' [*R.A.M.*, xvii, p. 197], the author describes a series of experiments, yielding only negative results, on the immunization by this method of the leaves of clover (*T[rifolium] pratense*) against *Macrosporium commune* [? *Stemphylium botryosum*] and *Rhizoctonia solani* var. *ambigua* (the 'toile' disease organism [ibid., xvii, p. 55]), and of maize roots against the latter fungus.

KAUSCHE (G. A.). **Zur Charakterisierung des Tabakmosaik- und Kartoffel-X-Virus mit der Goldsolreaktion.** [On the differentiation of Tobacco mosaic virus and Potato virus X by the gold sol reaction.]—*Biol. Zbl.*, lix, 3–4, pp. 194–221, 2 figs., 14 graphs, 1939.

From this amplified account of the writer's experiments in the differentiation of tobacco mosaic virus and potato virus X by means of their reactions to colloidal gold [*R.A.M.*, xvii, p. 832], it appears that the latter, at certain albumin concentrations, develops a voluminous red flocculation which is entirely absent from tobacco mosaic preparations. In addition to this phenomenon, known as the 'aggregation type' a blue flocculation ('nuclear type') may also be manifested by the potato virus.

KÖHLER (E.). **Über das Auftreten abweichender Varianten bei den Cs-Stämmen des Kartoffel-X-Virus.** [On the occurrence of aberrant variants in the Cs strains of Potato virus X.]—*Arch. ges. Virusforsch.*, i, 1, pp. 46–69, 7 figs., 1 diag., 1939.

The powerful strain Cs 36 of potato virus X [*R.A.M.*, xvii, p. 264] was readily induced to form an abundance of aberrant weak strains by heating the infective crude juice of diseased Samson Bashi Bagli stalked tobacco plants to the inactivation limit (66° C.), but the same procedure was ineffectual in the case of the relatively feeble Cs 35, which originally gave rise to Cs 36. The mutants developing from the homogeneous strains of Cs 35 and Cs 36 differ not only quantitatively, but also to some extent qualitatively, from their parents. So far, the strains derived from Cs A are classifiable in four groups according to the intensity of the symptoms produced in inoculations on tobacco. Two new variants of Cs 35, resembling but distinct from Cs 36, are named Cs 64/1 and Cs 64/2. The very powerful, slow moving Cs 37 differs from Cs 36 in the formation of a typical ring pattern instead of tortoise-shell. Cs 17, an aberrant strain of Cs 36, is closely allied to Cs 35 but has a longer incubation period.

The X-virus molecule is envisaged as composed of at least two parts, viz., a nucleus of specific constitution and one or more radicals

determining the intensity and nature of the pathological syndrome. Quantitative aberrations would thus depend on an increase or reduction in the number of the radicals, and qualitative on the substitution of one radical for another [cf. *R.A.M.*, xviii, p. 129].

Stevenson (F. J.), Schultz (E. S.), & Clark (C. F.). **Inheritance of immunity from virus X (latent mosaic) in the Potato.**—*Phytopathology*, xxix, 4, pp. 362–365, 1939.

At least six strains of potato virus X, the agent of latent mosaic, are stated to be distinguishable by their reactions on potato and *Datura stramonium*. From all these S41956 was found to be immune in graft tests [*R.A.M.*, xvi, p. 630]. The mode of inheritance of the character conferring immunity was studied in crosses between S41956 and two non-immune varieties, Katahdin and Earlaine, in a progeny of S41956 selfed, and in the progenies of two other immunes, 774–67 and 792–114 selfed. The percentage of immunity in the two crosses and in the selfed lines were 37 and from 72 to 78, respectively, these results being explicable on the usual basis of autotetraploid inheritance. Genes A and B both being essential for immunity, the immune plants used as parents in these experiments are assumed to possess the genetic constitution AA aa Bb bb, the non-immune being expressed by the formula aa aa bb bb. The ratios computed on the foundation of this hypothesis fit the observed data reasonably closely, the deviation, divided by the standard error, in no case exceeding two.

Stevenson (F. J.) & Clark (C. F.). **The Sebago Potato, a new variety resistant to late blight.**—*Circ. U.S. Dep. Agric.* 503, 6 pp., 2 figs., 1938. [Received June, 1939.]

During the last seven years the Sebago potato variety, derived from a cross between Chippewa and Katahdin, has proved to be moderately resistant to late blight (*Phytophthora infestans*) [*R.A.M.*, xviii, p. 271] and highly so to mild mosaic [ibid., xviii, p. 411] in field tests in Maine and (in 1937 only) in five counties of New York State. The new variety is fairly prolific and produces tubers of superior quality, so that it may well be of considerable value in late potato-growing sections where blight cannot be effectively combated by spraying.

Syre (H.). **Versuche zur Bekämpfung von Schorf und Rhizoctonia durch Beizung und Bodendesinfektion.** [Experiments in the control of scab and *Rhizoctonia* by steeping and soil disinfection.]—*Pflanzenbau*, xv, 9, pp. 346–360, 6 figs., 3 graphs, 1939.

The results [which are fully tabulated and discussed] of preliminary experiments in the control of potato scab [*Actinomyces scabies*] and *Rhizoctonia* [*Corticium solani*] at Stendal [near Magdeburg, Germany] by tuber-steeping and soil disinfection (separately and in combination) [*R.A.M.*, xvii, p. 835] showed that, generally speaking, the outcome of tuber treatment was too unreliable to justify the recommendation of this method of control, but in cases of mild tuber and soil infestation a degree of protection may be secured by three minutes' immersion in 0·2 per cent. aretan or sprinkling with the same preparation at 1 per cent. *C. solani* was, however, very effectively combated and yields sub-

stantially increased (up to 27 per cent.) by soil treatment with a mixture of superphosphate and the organic mercury preparations $P_1$ and $P_2$ (I. G. Farben) at the rate of 200 kg. per hect., the incidence of diseased tubers being reduced from 34 per cent. in the controls to 15 and 16 per cent. respectively, and scab attack declining from 87·4 per cent. (by weight) for the untreated tubers to 23·3 and 20·2 per cent., respectively.

DEML (H.). **Weitere Kartoffelbeizversuche mit Aretan.** [Further Potato disinfection experiments with aretan.]—*Ratschl. Haus, Garten, Feld*, xiv, 4, pp. 51–54, 2 figs., 1939.

Details are given of an experiment in the control of *Rhizoctonia* [*Corticium*] *solani* on Fridolin potatoes in swampy ground in the Danube Valley, Bavaria, by means of tuber disinfection with aretan [see preceding abstract]. Half of each of three plots was planted with treated and half with untreated tubers; the yield of the former was 186·2 and that of the latter 159·7 kg. In another test on sandy clay five plots of treated tubers produced a harvest of 439·5 kg., the corresponding figure for the untreated being 431·5.

VAN SCHREVEN (D. A.). **De gezondheidstoestand van de Aardappelplant onder den invloed van twaalf elementen.** [The influence of twelve elements on the growth of the potato.]—*Meded. Inst. Phytopath. Wageningen*, 84, 166 pp., 30 pl., 2 graphs, 1939. [English summary.]

Part of the information in this exhaustive treatise, supplemented by a 15-page bibliography, on the influence of a deficiency or excess of twelve important nutrient elements on the condition of potato plants has already been noticed from other sources [*R.A.M.*, xv, p. 253; xviii, p. 269], but anatomical studies on the effects of the various elements are here described, together with experimental observations on the effects of iron, zinc, sodium, and chlorine, in varying concentrations on some well-known commercial varieties. Attention is drawn to the simulation of primary leaf roll symptoms in plants suffering from phosphorus, zinc, or boron deficiency. True leaf roll, however, may be differentiated from nutritional disorders by phloem necrosis, in which the dead sieve-tubes react to phloroglucin and hydrochloric acid by a red coloration absent from the disorganized tissues of plants affected, for instance, by lack of boron. In severe cases of boron deficiency, moreover, the damage is not restricted to the phloem, as it invariably is with leaf roll. Medullary necrosis [ibid., xvi, p. 118], due to calcium deficiency, is stated to occur sporadically in Holland.

MARTIN (A. L.). **Possible cause of black kernels in Rice.**—*Plant Dis. Reptr*, xxiii, 5, pp. 83–84, 1939. [Mimeographed.]

The defect of rice known as 'black kernel' [*R.A.M.*, xvi, p. 490] is most prevalent in the United States on the Fortuna and Rexoro varieties, though virtually all commercial varieties are susceptible. The affected kernels cannot be detected before milling and their removal before marketing may involve considerable expense. Isolations from some 1,200 affected kernels sterilized externally with mercuric

chloride solution (1 in 1,000) most frequently yielded *Curvularia lunata* [ibid., xvi, p. 771, and above, p. 517], though occasionally *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], *Fusarium* sp., *Trichoconis caudata* [ibid., xvi, p. 490], and *Nigrospora* were also obtained. In field tests, dusting rice plants during flowering with pulverized black kernels gave 23 per cent. discoloured kernels in the mature grains; dipping blossoming heads of rice into an aqueous suspension of *C. lunata* spores gave 10·7 per cent. of black kernels. After harvesting, seeds from these dipped heads were incubated in a moist chamber for two weeks at 35° C., this treatment raising the percentage of black grains to 12·9 per cent. of the total grains. Though several organisms, which were neither pathogenic nor discolouring agents, grew over many of the seeds, *C. lunata* appeared in 67 out of 210 instances when black grains obtained by these treatments were cultured. Inoculations of rice seeds and seedlings with cultures of other fungi from discoloured kernels did not give rise to symptoms of black kernel. These results indicate that *C. lunata* may be the cause of black kernel disease of rice.

Tochinai (Y.) & Komiya (S.). **Studies on the infection of Piricularia oryzae Br. et Cav. on maltreated Rice plants.**—*J. Fac. Agric. Hokkaido Univ.*, xliv, 2, pp. 33–76, 1939.

When rice plants of a susceptible and a resistant variety were artificially infected with blast (*Piricularia oryzae*) [*R.A.M.*, xvii, p. 836; xviii, p. 272] after pricking, cutting, or bruising the leaves, or after exposure to drought for three to six days, to the vapour of ether, chloroform, or absolute alcohol, or to high atmospheric temperature, the treated plants developed a higher percentage of infection than the inoculated, untreated controls. Infection tended to be reduced, however, by exposure to a saturated atmosphere for periods up to 72 hours before inoculation.

De Fluiter (H. J.). **Helicobasidium compactum Boedijn als parasitaire wortelschimmel van Hevea brasiliensis.** [*Helicobasidium compactum* Boedijn as a parasitic root fungus of *Hevea brasiliensis*.]—*Bergcultures*, xiii, 13, pp. 392–398, 4 figs., 1939.

Attention is drawn to the sporadic occurrence in Java of *Helicobasidium compactum* [see above, p. 503] in a severely parasitic form on rubber (*Hevea brasiliensis*) roots [*R.A.M.*, xvi, p. 160], and an account is given of three attacks of the fungus on the same estate in 1935, 1938, and the beginning of 1939. On the last-named occasion many lateral roots were found to have died back, the necrotic tissues being sharply delimited from the healthy and covered with a brown fungal network and numerous minute points, which were shown by microscopic examination to be the 'pseudosclerotia' of *H. compactum* as described by Boedijn and Steinmann [ibid., ix, p. 562]. In a dry state the roots were traversed by the typical chocolate-brown, purple-shot mycelium of the fungus. Adventitious roots were formed freely at the junction of diseased and sound tissues. Sparse crowns and shrivelled branches were features of trees with a badly infected root system. Control measures, on the usual lines of stringent sanitation of diseased plantations, are briefly indicated.

**Bibliography of references to the literature on the minor elements and their relation to plant and animal nutrition.** Third Edition.—488 pp., Chilean Nitrate Educational Bureau, Inc., 120 Broadway, New York, and the Nitrate Corporation of Chile Limited, London, 1939.

The present edition of this annotated bibliography of the literature on the relation between minor elements and plant nutrition, originally compiled by L. G. Willis [*R.A.M.*, xvi, p. 276], has been enlarged to include papers on animal nutrition, and now contains 4,628 abstracts and references.

Teakle (L. J. H.) & Stewart (A. M.). **Response to copper as a fertilizer on certain soils in Western Australia.**—*J. Aust. Inst. agric. Sci.*, v, 1, pp. 50–53, 1939.

In experiments commenced in 1937 in the Albany district of Western Australia the application to an acid black muck soil of a mixture containing copper, manganese, zinc, and magnesium sulphates, each at the rate of 20 lb. per acre, in addition to a 'complete' fertilizer, resulted in a 40 per cent. increase in yield of potatoes. The succeeding oats and potato crops also showed a marked response to the residues of the minor elements, primarily to copper [cf. *R.A.M.*, xvii, p. 508]. During 1938 satisfactory results were achieved on a variety of crops and soil types with copper sulphate dressings ranging from 8 to 15 lb. per acre, while most of the crops did not grow at all on undressed soils. In experiments with duplicated plots of 0·43 acre each on various types of soils the lateritic gravelly sands at Wagin responded best to copper (applied as sulphate), while other minor elements had no appreciable effect. Nabawa wheat grown on copper treated plots of clean fallow throve, had strong roots and well-formed heads, and matured normally, while plants on plots treated with other elements exhibited poor growth and failed to mature. The yield on the copper-treated plot was equivalent to over 25 bush. per acre, though this soil type had failed to mature a crop in the last 20 years. Copper in combination with manganese and zinc was not superior to copper alone.

Teakle (L. J. H.) & Morgan (E. T.). **Recent experiments with 'minor' elements in Western Australia. I. A brief review of the 'minor' element question in Western Australia. II. Experiments with 'minor' elements on the growth of Potatoes, vegetables, and pastures.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xvi, 1, pp. 116–128, 5 figs., 1939.

In the first of these papers, L. J. H. Teakle briefly touches on the question of the deficiency of Western Australian soils in minor elements, and adduces various examples of important responses brought about locally by applications of copper [see preceding abstract], manganese, zinc, and cobalt. In the second paper, the authors describe experiments made with minor elements, the [tabulated] results of which indicated that on marly peat soils of coastal swamps in the Albany district manganese sulphate applications will probably prove beneficial to potatoes, runner beans [*Phaseolus multiflorus*], cabbages, swedes, turnips, peas, and tomatoes; copper, in addition to manganese,

may prove beneficial on these soils to peas, swedes, and cabbages. On acidic soil types (including swamp soils, soils of bottle brush [*Callistemon*] flats, and brown, sandy soils of karri [*Eucalyptus diversicolor*] hills of the Albany district) copper was of great value to truck crops, potatoes, and pastures. It would appear to be unnecessary to use copper sulphate or manganese sulphate at rates of over 15 lb. per acre.

HEIM (R.) & BOURIQUET (G.). **Maladies et champignons du Giroflier à Madagascar.** [Diseases and fungi of the Clove in Madagascar.] —*Rev. Path. vég.*, xxvi, 1, pp. 5–35, 3 pl., 9 figs., 1939.

Clove 'apoplexy' [*R.A.M.*, xvi, p. 340] appears to have been present in Madagascar for over 30 years. No severe outbreak has occurred since 1907, in spite of the planting, between 1924 and 1926, of over 1,000,000 clove trees in one area alone. Trees under six or over ten years old are unaffected. The highest proportion of trees found affected in any plantation was 1 in 30, the figure in most cases ranging from 1 in 200 to 1 in 1,500. Only isolated trees are attacked, though the condition may affect several trees in the same straight line. Trees from seed fallen from diseased ones grow up unaffected in the same soil as the parent. In every case examined, the extremities of the pivotal roots of trees killed by the condition were found to be in close proximity to pieces of stone, and it is thought that the disease is physiological in origin. It is unlikely that the condition is the same as the 'sudden death' of cloves in Zanzibar [ibid., xvii, p. 626], which may be identical with the true root rot affecting cloves in Madagascar [ibid., xvi, p. 341].

The first symptom of clove apoplexy is a sudden wilting and discoloration of the leaves of a single tree, or of a few isolated ones, the rest of the plantation remaining unaffected. In less than a fortnight, defoliation is all but complete. Meanwhile, the branches start to wither, and death rapidly ensues. Very occasionally, only part of a tree may at first be affected.

Further details are given of the true root rot previously recorded [loc. cit.] and anthracnose (*Mycosphaerella caryophyllata* n. sp.) [loc. cit.]. The latter is very prevalent in Madagascar, causing orbicular, cream-coloured spots with reddish-brown peripheries, 4 to 16 mm. in diameter, on which are borne the perithecia with asci 50 to 68 by 13 to 17 $\mu$, narrowing to 7 to 9 $\mu$ in the thick-walled upper portion, and unequally uniseptate ascospores, 21 to 27 by (for the larger of the two cells) 4 to 4·7 $\mu$. *Cephaleuros virescens*, sooty moulds, and various saprophytic fungi on cloves are also recorded.

HOERNER (G. R.). **Hop anthracnose.**—*Plant Dis. Reptr*, xxiii, 7, pp. 123–124, 1939. [Mimeographed.]

Details are given of the herbarium specimens of hop anthracnose from various parts of the United States examined since the publication of a recent note on the disease, in which the causal organism is identified as the conidial stage of *Glomerella cingulata* [*R.A.M.*, xvii, p. 703]. In the writer's opinion the fungus should be classed, pending the detection of the perfect stage, among the Fungi Imperfecti; probably all the hop leaf spots hitherto reported under the name of anthracnose are due to *Colletotrichum humuli* Dearness.

**Cane disease situation in the Bundaberg district.**—*Aust. Sug. J.*, xxx, 12, pp. 737–738, 1939.

In a report on the present status of Fiji disease and downy mildew of sugar-cane [*Sclerospora sacchari*] in the Bundaberg district of Queensland [*R.A.M.*, xviii, p. 274], the Director of the Bureau of Sugar Experiment Stations states that the former was observed on 82 farms and four plantations during the past year. Nearly all the diseased fields are occupied by the susceptible P.O.J.2878 variety. P.O.J.2725 and 2714 are also highly susceptible, and occasional infection of M.1900 S[eedling] has further been noted in the older diseased areas. D.1135, though susceptible, was not found to be infected during the period under review. Co.290, P.O.J.213, and P.O.J.234 are highly resistant to Fiji disease, and Q.813, Oramboo, and Korpi reasonably so. Downy mildew is reported to have increased at an alarming rate, occurring on 98 farms and four plantations, chiefly on P.O.J.2878 and 213. D.1135 and P.O.J.234 are moderately susceptible, and P.O.J.2725 and Co.290 fairly resistant, to *S. sacchari*. A considerable amount of downy mildew has been observed on maize, and investigations are in progress at Brisbane to determine the relationship of the strains on this host and sugar-cane.

Viennot-Bourgin (G.). **Contribution à l'étude de la flore cryptogamique du bassin de la Seine. 14e Note. A propos de deux Uromyces parasites des Légumineuses: Uromyces briardi Hariot et Uromyces anthyllidis (Grev.) Schroet.** [A contribution to the study of the cryptogamic flora of the Seine basin. 14th Note. On two *Uromyces* parasitic on Legumes: *U. briardi* Hariot and *U. anthyllidis* (Grev.) Schroet.]—*Rev. Path. vég.*, xvi, 1, pp. 66–92, 3 pl., 1939.

In comparative studies on *Uromyces briardi* and *U. fabae*, both found on *Vicia angustifolia* near Grignon, Paris, the author found that the uredospores of the former were usually globular, sparsely echinulate, and measured 20·3 to 26·1 by 15·9 to 23·2 μ, whereas those of the latter were often (more than 30 per cent.) ovoid or long ovoid, smooth, and 21·7 to 30·5 by 15·9 to 24·6 μ. From observations made on *U. anthyllidis* [*R.A.M.*, i, p. 34] found on *Medicago maculata* at Grignon, and from herbarium material on leguminous plants he concludes that the characters of this species are as follows: globular or subglobular uredospores with a brownish epispore 2·8 to 4 μ thick; 3 to 8 germ pores, almost always visible; globular ovoid, occasionally angular teleutospores with a brown, opaque epispore 1·8 to 4 μ thick, distinctly verrucose, with conical protuberances squat at the base, with a germ pore covered with a brownish papilla of verrucose folds. On this basis the following fungi, among others listed, are included in the species, viz., *U. trigonellae* on *Trigonella foenum-graecum* [ibid., xii, p. 660], *U. renovatus* on *Lupinus* [ibid., xvi, p. 207], and *U. ciceris-arietini* on *Cicer arietinum* [ibid., ix, p. 204]. Evidence was obtained from glasshouse experiments that *U. anthyllidis* on *M. maculata* is specialized to *Medicago* and the form of the fungus on this host is therefore named *U. anthyllidis* f. *medicaginis*.

NATTRASS (R. M.) & PAPAIOANNOU (P.). **Additions to a first list of Cyprus fungi.**—*Cyprus agric. J.*, xxxiv, 1, pp. 25–29, 1939.

This additional list of Cyprus fungi [cf. *R.A.M.*, xvii, p. 346] collected up to May, 1938, comprises 33 species. A host index is appended.

WATERSTON (J. M.). **Annotated list of diseases of cultivated plants in Bermuda.**—x+36 pp., Govt. Printer, Hamilton, 1939.

An annotated list is given of the diseases of plants cultivated in the Bermudas, arranged under hosts, followed by a check list of the fungi and bacteria involved, the virus diseases, and the non-parasitic diseases. Of the 251 diseases listed 200 are due to fungi, 19 to bacteria, 18 to viruses, and 10 to non-parasitic causes. A bibliography of 37 titles is appended.

MAIRE (R.) & WERNER (R. G.). **Catalogue raisonné des champignons connus jusqu'ici au Maroc.** [An annotated list of the fungi hitherto recognized in Morocco.]—*Mém. Soc. Sci. nat. Maroc.*, xlv, 148 pp., 1937 (issued 1938).

An annotated list is given of the 1,242 species of fungi recognized up to the date of compilation in French Morocco; 100 are peculiar to the country, 30 new to science [with Latin diagnoses], and 238 new records for Morocco [cf. *R.A.M.*, xvii, p. 507]. Among the items not already noticed from other sources may be mentioned *Asterocystis radicis* on flax [ibid., xvii, p. 654; xviii, p. 483]; *Peronospora arborescens* on poppies (*Papaver hybridum*, *P. rhoeas* [ibid., xviii, p. 140], *P. dubium*, and *P. setigerum*); *Peronospora spinaciae* on spinach [ibid., xviii, p. 275]; *Taphrina deformans* on almond and peach [ibid., xvii, p. 585 *et passim*]; *Microsphaera alphitoides* (*M. alni* f. *quercina*) [*M. quercina*] on oaks (*Quercus faginea* and *Q. pyrenaica*) [ibid., xvii, p. 438]; *Guignardia bidwellii* on vines; *Mycosphaerella sentina* on pear leaves [ibid., xvi, p. 191]; *Ophiobolus graminis* on wheat, barley, and *Phalaris canariensis*; *Polystigma rubrum* on almond [ibid., xvi, p. 392]; *Gibberella saubinetii* on *Asparagus albus*; *Claviceps purpurea* on *Avena jahandeiezii*, *Haynaldia hordeacea*, and *Festuca arundinacea*; *Lophodermium pinastri* on fallen pine needles; *Rhytisma acerinum* [ibid., xv, p. 184] and *R. salicinum* [ibid., xv, p. 259] on *Acer monspessulanum* and *Salix purpurea* foliage, respectively; *Pseudopeziza medicaginis* on living lucerne leaves [ibid., xviii, p. 397]; *Ustilago avenae* on cultivated and wild oats; *U. bromivora* [ibid., xvii, pp. 505, 618] on six species of *Bromus*; *U. hordei* on barley and *Elymus caput-medusae*; *U. tritici* on wheat; *U. zeae* on maize; *Sphacelotheca reiliana* [*Sorosporium reilianum*] on sorghum [see above, p. 517] and *Sorghum halepense*; *Tilletia levis* [*T. foetens*] and *T. caries* on wheat, the former also on *Triticum durum*; the aecidia of *Coleosporium inulae* on *Pinus halepensis* [ibid., viii, p. 210]; *Gymnosporangium confusum* on *Juniperus phoenicea* (aecidial stage on quince [ibid., xi, p. 145] and *Crataegus monogyna*); *G. oxycedri* on *J. oxycedrus* [ibid., ix, p. 754] (*C. monogyna*); *Puccinia allii* on *Allium* spp. [ibid., xvi, p. 563] including leeks; *P. coronata* on *Avena sterilis* and *Rhamnus oleoides*; *P. glumarum* on wheat, *T. durum*, barley, and rye; *P. helianthi* on sunflower; *P. simplex* [*P. anomala*] on barley, *Hordeum bulbosum*, and *Ornithogalum umbellatum* var. *longibracteatum*;

*P. malvacearum* on hollyhock [ibid., xv, pp. 109, 776] and other Malvaceae; *P. maydis* on maize; *P. menthae* on cultivated peppermint (*Mentha piperita*) [ibid., xvii, pp. 485, 771], and other Labiatae; *P. purpurea* on sorghum [see above, p. 517]; *P. triticina* on wheat; *Stereum hirsutum* on oaks (*Q. ilex, Q. faginea,* and *Q. coccifera*) and *Acacia retinodes*; *Fomes fomentarius* [ibid., xviii, p. 361] on poplar; *Ganoderma applanatum* on orange [ibid., xv, p. 16]; *Phyllosticta* [*Ascochyta*] *rabiei* on chick pea [ibid., xvii, p. 501]; *Phoma omnivora* on lemon fruits; *Macrophoma* [*Macrophomina*] *phaseoli* on broad and French beans [*Vicia faba* and *Phaseolus vulgaris*], spinach, maize, and carrots; *Septoria antirrhini* on *Antirrhinum majus* leaves [ibid., xvi, p. 563]; *S. apii* on celery; *S. graminum* on oats, wheat, *Poa annua*, and *Aira caryophyllea* [ibid., xviii, p. 297]; *Marssonina juglandis* [*Gnomonia leptostyla*:, [ibid. xvii, p. 654] and *Microstroma juglandis* [ibid., xvi, p. 642] on walnut (*Juglans regia*); *Helminthosporium sativum* on barley; and *Cercospora beticola* on beet.

FAULL (J. H.). **The biology of rusts of the genus Uredinopsis.**—*J. Arnold Arbor.*, xix, 4, pp. 402–436, 1938.

Species of *Uredinopsis* are known to pass through their diploid phase on one genus (*Osmunda*) of the Osmundaceae and on twelve of the Polypodiaceae, while the haploid stage occurs in nature, or has been obtained in culture, on *Abies alba*, *A. balsamea*, *A. firma*, *A. grandis*, *A. mayriana*, and *A. sachalinensis*. The life-histories of 16 of the 25 recognized *U.* spp. have been demonstrated by cultural studies at the Arnold Arboretum, details of which are here presented in connexion with *U. ceratophora*, *U. longimucronata*, *U. mirabilis* [*R.A.M.*, xiv, p. 482], *U. osmundae*, *U. phegopteridis*, and *U. struthiopteridis*. Teleutospores have been observed in all the known *U.* spp. except *U. investita* and *U. mayoriana*. The formation of these organs may begin as early as midsummer, nutritional rather than seasonal factors probably being concerned in the inception of the process. The teleutospores overwinter in dead infected fronds and become viable in the following spring.

Incidental evidence (requiring further confirmation) is forthcoming in support of the view that all or most *A.* spp. are liable to contract infection by all *U.* spp., though the latter have been shown by W. P. Fraser (*Mycologia*, vi, pp. 25–28, 1914) and the author to be strictly specialized in respect of their fern hosts. For instance, in the present investigations, the pathogenicity of *U. struthiopteridis* was restricted in cross-inoculations to *Matteuccia struthiopteris*, that of *U. mirabilis* to *Onodea sensibilis*, of *U. longimucronata* to *Athyrium angustum*, of *U. phegopteridis* to *Dryopteris linnaeana*, and of *U. osmundae* to *Osmunda claytoniana*. The last-named rust was found to comprise two physiologic races, one infecting *O. claytoniana*, *O. regalis* var. *spectabilis*, and *O. cinnamomea* and the other attacking the first two only.

Both firs and ferns sustain appreciable economic damage from *Uredinopsis* infection.

MAINS (E. B.). **Scopella gen. nov. of the Pucciniaceae.**—*Ann. mycol., Berl.*, xxxvii, 1–2, pp. 57–60, 1939.

The author erects a new genus, *Scopella* [with a Latin diagnosis],

characterized by subcuticular, hemispherical pycnidia; subepidermal pulverulent uredosori; brown, pedicellate uredospores, arising in groups from free cylindrical cells; subepidermal teleutosori; and unicellular, pedicellate, very thin-walled, hyaline teleutospores produced in the same way as the uredospores. The type species is *S. echinulata* (Niessl) n. comb. (*Uromyces echinulatus*), while *S. sapotae* (Arthur & Johnston) n. comb. (*Uredo sapotae*), found by the writer on *Achras sapota* in British Honduras in 1936, had previously been observed on the same host in the Bahamas, Dominica, and Cuba.

Kochman (J.). **Przyczynek do znajomości flory głowni polskich** (II). [A contribution to the knowledge of Polish smut fungi (II).]—*Acta Soc. Bot. Polon.*, xvi, 1, pp. 53–67, 2 figs., 2 pl., 1939.

In this further contribution to the study of smuts in Poland [*R.A.M.*, xvi, p. 62] nine species are discussed, bringing the total number of records up to 142 species. *Tuburcinia avenae-elatioris* n.sp. on *Avena elatior* [*Arrhenatherum avenaceum*] shows a strong morphological resemblance to *T. agropyri* but in inoculation experiments did not infect the latter's host *Triticum* [*Agropyron*] *repens*, while *Tuburcinia* [*Urocystis*] *agropyri* did not infect *Arrhenatherum avenaceum*. The author erects a new genus *Glomosporium* on the basis of *Tolyposporium leptideum* from *Chenopodium album*, and includes it in the Tilletiaceae.

Voorhees (R. K.). **The validity and morphology of two Tryblidiella species.**—*Mycologia*, xxxi, 2, pp. 113–123, 4 figs., 1939.

The author recognizes *Tryblidiella fusca* and *T. rufula* [*R.A.M.*, xii, p. 790] as two distinct species on the basis of the morphological characters of the ascocarps. Each produced pycnidia and spermogonia in culture but not in nature, and the general character and appearance of the pycnospores were similar to those of the genus *Diplodia*, though neither species showed markings on the spores corresponding to those of *D. natalensis*. It is considered remarkable that the pycnidial forms of such widely separated genera as *Tryblidiella* and *Physalospora* should be referred to the same form genus, *Diplodia*, and it is suggested that a more thorough study of these pycnidial forms may reveal sufficient differences to separate the imperfect species generically.

Tai (F. L.) & Cheo (C. C.). **Notes on Chinese fungi VIII.**—*Bull. Chin. bot. Soc.*, iii, 1, pp. 53–69, 2 pl., 1937. [Received June, 1939.]

Included in this annotated list of 46 Chinese rusts are eleven new species (with Latin diagnoses). *Phragmidium shensianum* n.sp., occurring on raspberries, is characterized by orange-yellow uredosori, $\frac{1}{3}$ to $\frac{1}{2}$ mm. in diameter, numerous cylindrical or clavate, suberect to incurved, hyaline paraphyses, subglobose or ovate, sparsely verrucose, pale yellow uredospores, 20 to 24 by 15 to 21 $\mu$, with 3 to 5 germ pores, black teleutosori, 0·5 to 1 mm. in width, and cylindrical, pale yellow 4- to 8-, commonly 6- or 7-, rarely biseptate teleutospores, 51 to 115 by 31 to 36 $\mu$ (average 103 by 32 $\mu$), with a blunt, pale yellow apiculum, 3 to 14 $\mu$ in height, a densely verrucose, chestnut-brown epispore, and a hyaline to faintly tinted pedicel, up to 167 $\mu$ in length and 14 to 21 $\mu$ in breadth at the base. Among the other records may be mentioned

*P. rubi-parvifolii* on raspberry, and *Uromyces fabae* on broad beans and *Vicia unijuga*.

McAuliffe (H. D.), Farrell (M. A.), Haley (D. E.), & Reid (J. J.). **A study of the epidemiology of Tobacco wildfire.**—Abs. in *J. Bact.*, xxxvii, 2, p. 234, 1939.

The incidence of tobacco wildfire in an epidemiological survey in Pennsylvania was found to be unrelated to that of *Phytomonas tabaca* [*Bacterium tabacum*: *R.A.M.*, xvii, pp. 353, 712, 732], which was present in all the plants examined whether or not they showed external evidence of disease. Normal tobacco of the cigar-leaf filler type was observed to be highly resistant to infection of economic severity during the growing period. Such plants contain a nitrogen-potassium ratio of somewhat less than one. Relative susceptibility, on the other hand, was exhibited by plants with a ratio exceeding one. During the ripening phase, susceptibility to wildfire may be acquired, regardless of previous nutrition, if any considerable amount of nitrogen is absorbed; this type of liability to the disease is increased by topping and suckering. Wildfire control would thus appear to be largely a matter of judicious plant nutrition.

Naghski (J.), McAuliffe (H. D.), Haley (D. E.), & Reid (J. J.). **The relation of delayed ammonification and nitrification to leaf spot diseases.**—Abs. in *J. Bact.*, xxxvii, 2, p. 234, 1939.

The significant uptake of nitrogen associated with the susceptibility of tobacco to leaf spot disease [*Bacterium tabacum* and *Bact. angulatum*: see preceding and next abstracts] during the ripening period in Pennsylvania was shown to be correlated with excessive amounts of nitrates in the soil, caused in some instances by delayed ammonification and nitrification of the organic nitrogen applied in the spring, and in others by the retarded nitrification of ammonium salts, which have probably remained for lengthy periods in a relatively insoluble form, e.g., ammonium magnesium phosphate. An insufficient spring rainfall usually induces delayed ammonification and nitrification, while the subsequent occurrence of heavy precipitation as the crop approaches maturity leads to an intensification of these processes and consequent loss of resistance to disease in the crop. It is concluded from these observations that the incorporation of large amounts of complex organic nitrogen in a soil to be used for tobacco is unsafe. Hence tobacco should not follow a leguminous crop, nor should fresh animal manure be applied to the soil.

Reid (J. J.), Naghski (J.), Harris (R. G.), & McAuliffe (H. D.). **A cultural and serological study of Phytomonas tabaca and certain related forms.**—Abs. in *J. Bact.*, xxxvii, 2, pp. 234–235, 1939.

A comparative physiological and serological investigation at the Pennsylvania Agricultural Experiment Station of strains of *Phytomonas tabaca* [*Bact. tabacum*], other *P.* spp. [including *Bact. angulatum*] associated with tobacco leaf spots [see preceding abstracts], known strains of *Pseudomonas fluorescens*, and over 2,000 isolations of

the last named from normal tobacco and clover, showed that *P. fluorescens* becomes indistinguishable from *Bact. tabacum* in these respects when cultured in untreated plant extracts with a high nitrogen content. The similarity thus induced may be lost as rapidly as it is acquired by frequent passage through other artificial media. It is concluded from these results that *Bact. tabacum* represents a purely transient physiological adaptation of *P. fluorescens*, and the same probably applies to the other leaf-spotting *Bact.* spp., though the evidence from tests with the latter was not quite as definite as that from the wildfire trials.

THUNG (T. H.). **Phytopathologische waarnemingen.** [Phytopathological observations.]—*ex* Jaarverslag 1937–1938 [Annual Report for 1937–8].—*Meded. Proefst. vorstenl. Tab.*, 87, pp. 23–46, 2 pl., 1939.

During the period under review the average incidence of mosaic in the Vorstenland tobacco plantations [*R.A.M.*, xviii, p. 207] amounted to 1 per cent. at the onset of active growth about a week after the first irrigation and spread rapidly. Of the various chemicals tested for the disinfection of the coolies' hands between one cultural operation and another, 4 per cent. commercial formalin for five minutes was the only one suitable for practical use [ibid., xvii, p. 489]. At the Deli (Sumatra) Experiment Station the American recommendation of trisodium phosphate [ibid., xvi, p. 658] is preferred to formalin, and the writer's experiments with this preparation at concentrations exceeding 8 per cent. also gave satisfactory results. The immunization of tobacco plants against severe mosaic by inoculation with the mild strain of the disease, thereby preventing heavy losses, was experimentally shown to be feasible.

Other virus diseases of tobacco causing severe damage during 1937–8 were perforation or pox, a disorder associated with foliar crinkling and prominent white spotting (D), probably transmitted by *Bemisia*, a mosaic producing long, filiform leaves (M), and a sap-transmissible disturbance characterized by drooping of the middle leaves, accompanied by brown depressions along the veins and mottling of the upper foliage. Of these, the first-named has been found to originate in lombok [*Capsicum minimum*] plantings, whence it is conveyed to tobacco by *Myzus persicae*; on *C. minimum* the symptoms are frequently masked.

Groundnuts appear to promote heavier attacks of slime disease (*B*[*acterium*] *solanacearum*) in the succeeding tobacco crop [ibid., xviii, p. 279] than rice. Successful control of this disease, the incidence of which is undoubtedly on the increase in the Vorstenland, has been achieved by soil disinfection with cryptonol [ibid., xvii, p. 182] or terbolan [ibid., xvi, p. 780], supplemented by hoeing and drying-out of the beds. It was ascertained by two methods (planting in a diseased field plot and in inoculated soil in trays) that the hybrids R749×R518, R518×R.v.Am., and R749×KW10, are considerably more resistant to *Bact. solanacearum* than the Kamari controls.

Of recent years there has been a marked local decline in the amount of infection by *Phytophthora* [*parasitica* var. *nicotianae*: ibid., xviii,

p. 419], the number of dead plants over an area of 540 bouws [1 bouw = 0·71 hect.] on 30th November, 1938, being 69,995 as compared with 229,991 on the corresponding date in 1934 (536 bouws); some of these losses, moreover, are attributable to *Bact. solanacearum*, the two diseases being indistinguishable in the later stages.

There was no appreciable extension of mildew [*Erysiphe cichoracearum*] during the period covered by the report. In a plot where the routine sulphur spraying was omitted the Timor-Vorstenland variety remained practically immune from infection, whereas the adjacent rows of Chl[orina]×KW10 were heavily attacked.

Brief notes are given on the tobacco diseases due to *Bacillus* [*Erwinia*] *aroideae*, *Cercospora* [*nicotianae*], and *Alternaria longipes* [ibid., xvii, p. 490].

Szirmai (J.). **Untersuchungen und Beobachtungen an 'necrotic virus' im Zusammenhang mit dem Pilz Thielavia basicola Zopf.** [Studies and observations on 'necrotic virus' in connexion with the fungus *Thielavia basicola* Zopf.]—*Phytopath. Z.*, xii, 2, pp. 219–227, 7 figs., 1939.

Greenhouse-grown tobacco seedlings [(?) in Hungary] were found exhibiting a necrotic flecking of the leaves which was identified as a symptom of K. M. Smith's tobacco necrosis [*R.A.M.*, xvi, p. 570]. Examination of the root system of inoculated plants revealed the association of *Thielavia* [*Thielaviopsis*] *basicola* with the virus disease. The fungus was grown in culture and inoculation experiments on tobacco leaves with suspensions of the fungus resulted in the development of angular, coalescent spots which, although quite distinct from those caused by the virus, continued to enlarge after cessation of the growth of the fungus. The author tentatively attributes this increase in size of the spots to the secretion by the fungus of a virus-containing enzyme, and from additional experiments, which showed that lesions are only produced by living cultures of the fungus and that leaves inoculated with *T. basicola* alone contain no virus, concludes that a necrotic virus can only originate by an interaction, of a nature not yet fully understood, between the fungus and the root contents.

Godoy (E. F.). **El Oidium del Tomate. Su presencia en la Argentina.** [The *Oidium* of the Tomato. Its presence in the Argentine.]—*Rev. argent. Agron.*, vi, 1, pp. 49–52, 3 figs., 1939.

Forced tomato leaves and shoots in Jujuy, Argentine Republic, were attacked in July, 1938, by a species of *Oidium*, the initial white efflorescence being later replaced by chestnut-coloured, necrotic lesions involving the complete decay of the plants. The economic importance of the disease is considerable. The fungus has very short, septate conidiophores bearing at their apices chains of five to eight hyaline, ovoid or barrel-shaped conidia, 20·4 by 14·8 to 36·7 by 18·8 (average 25·8 by 15·9) $\mu$, and possibly represents the imperfect stage (*O. erysiphoides*) of *Erysiphe polygoni* [cf. *R.A.M.*, vii, p. 674; x, p. 11]. Good control may be obtained by timely applications of ground sulphur.

KAUSCHE (G. A.). **Über die Darstellung von Kristallen und die Färbbarkeit des Aucubamosaik-Virus.** [On the preparation of crystals and the staining reaction of the aucuba mosaic virus.]—*Naturwissenschaften*, xxvii, 13, p. 212, 2 figs., 1939.

The author obtained hexagonal crystals resembling those found in the trichomes and epidermal cells of aucuba mosaic-diseased [tomato] plants [*R.A.M.*, xviii, p. 212] by placing in a moist chamber a slide bearing the centrifuged sediment of the virus precipitated with ammonium sulphate at $P_H$ 5·5 and virus-containing expressed sap purified with animal charcoal. Data are also given, based on the staining of air-dry streaks of the virus crystals [ibid., xviii, p. 415] by simultan H and Victoria blue 4R Herzberg [ibid., xviii, p. 211], which are considered to establish a very close connexion between the tobacco [ibid., xviii, p. 481] mosaic and the tomato aucuba mosaic viruses.

BEST (R. J.). **The preservative effect of some reducing systems on the virus of Tomato spotted wilt.**—*Aust. J. exp. Biol. med. Sci.*, xvii, 1, pp. 1–17, 1 graph, 1939.

The effect of various reducing systems on the activity of suspensions of the virus of tomato spotted wilt from Blue Pryor tobacco plants was tested at the Waite Agricultural Research Institute, Adelaide [*R.A.M.*, xvii, p. 141].)

Hydrogen in the presence of platinized platinum arrested the normal aerobic inactivation of the virus in a buffer solution at $P_H$ 7, and thereafter maintained the infective principle in an active state for the duration of the test (eight hours). Suspensions of the virus in the presence of cystein (0·01M) and absence of oxygen at $P_H$ 7·5 were kept active for 35 days as compared with the normal *in vitro* period of a few hours. The sodium salts of glutathione, thioglycollic acid, and ascorbic acid (0·01M) protected the virus against rapid aerobic inactivation at $P_H$ 7. Adrenalin at the same strength failed to prevent aerobic inactivation but was effective against the slow decline of virulence normally occurring in the absence of oxygen.

Discussing the redox potentials of the various reducing substances in relation to their relative efficiency as inactivation preventives, the writer points out the importance of allowing sufficient time for the attainment of an 'equilibrium'. The redox potentials at 'equilibrium' at 18° C. were (when oxygen was excluded throughout): glutathione −0·113, thioglycollic acid −0·102, ascorbic acid + 0·062, and adrenalin +0·107; the corresponding figures (after exposure to air) being + 0·006, −0·055, +0·096, and +0·123, respectively. These values are regarded as affording a convincing explanation of the action of the three first-named substances on the tomato spotted wilt virus; the adrenalin values are more difficult to interpret and must be considered in the light of the intensity and rate of reaction factors.

HUELSEN (W. A.). **Wilt-resistant Tomato varieties released by the Illinois Station.**—*Circ. Ill. agric. Exp. Sta.* 490, 22 pp., 9 figs., 1939.

In this circular, a revision of number 448, issued in 1936 [*R.A.M.*, xvi, p. 132], the Illinois Baltimore tomato is added to the list of field

varieties resistant to wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) [ibid., xviii, p. 422].

McCormick (Florence A.). **'Cephalosporium die-back' of Elms.**—*Phytopathology*, xxix, 4, pp. 371–372, 1939.

*Dothiorella ulmi*, the agent of *Cephalosporium* die-back of elms [*R.A.M.*, xviii, p. 281], the most prevalent disease of the tree in Connecticut, is ordinarily very virulent, but two elms have survived an eleven-year period of infection without apparent deterioration in health—in fact, rather the reverse. Inoculation experiments with cultures from the diseased tissues have resulted only in mild infection, an indication of the exceptionally weak parasitism of the strain of *D. ulmi* concerned.

Fransen (J. J.). **Iepenziekte, Iepenspintkevers en beider bestrijding.** [The Elm disease, Elm bark beetles, and their joint control.]—Thesis, Wageningen Agricultural College, 118 pp., 3 graphs, 1939.

This is a comprehensive, fully tabulated summary of the results (already published in part from other sources) of investigations which have been in progress in Holland and elsewhere since 1930 in the joint control of the elm disease (*Ceratostomella ulmi*) and its insect vectors, *Scolytus scolytus* and *S. multistriatus* [*R.A.M.*, xvii, p. 142]. In connexion with the biological control of the beetles, mention is made of the parts played in their extermination by *Beauveria bassiana* [ibid., xiii, p. 549 and above, p. 521], numerous insects, nematodes, mites, and certain birds, such as tits, nuthatches, robins, and woodpeckers. A five-page bibliography is appended.

Went (Johanna C.). **Verslag van de onderzoekingen over de Iepenziekte verricht op het Phytopathologisch Laboratorium 'Willie Commelin Scholten' te Baarn, gedurende 1938.** [Report on the Elm disease investigations conducted at the 'Willie Commelin Scholten' Phytopathological Laboratory, Baarn, during 1938.]—*Tijdschr. PlZiekt.*, xlv, 2, pp. 52–62, 1939.

This is a further progress report on the work of testing elm seedlings for their reaction to *Ceratostomella ulmi* [*R.A.M.*, xvii, p. 780 and next abstracts], the inoculations being performed both by needle pricks and with the aid of infected [*Scolytus*] bark beetles. Of a total of 308 open-pollinated seedlings of *Ulmus foliacea*, *U. glabra*, and *U. pumila* (including a number of the two first-named from Rumania), 130 contracted the disease (six in a mild form). The survival of a large percentage of French and Spanish material of *U. foliacea* in a Utrecht nursery is attributed rather to their slow growth in the local heavy clay soil (unsuitable for the purpose in view) than to any strong inherent resistance to the fungus. The percentage of two-year-old seedlings of different varieties of *U. hollandica*, *U. glabra*, *U. foliacea*, *U. turkestanica*, and *U. laevis* (female parent only known) contracting infection was 54, the corresponding figure for three-year-old specimens of the same, excluding the two last-named and with the addition of *U. procera vanhouttei*, being 74. In experiments on selected lines, Nos. 42 and 43 of *U. foliacea*, of Spanish origin, proved highly resistant

(though in inoculations with beetles the former was less reliable), while the Christine Buisman variety also continued to give satisfactory results.

*C. ulmi* was not destroyed by the application of copper sulphate to the bark as recommended in the United States [ibid., xvii, p. 568].

KRIJTHE (N.). **Verslag over de werkzaamheden voor het Iepenziekte-Comité verricht aan het Laboratorium voor Erfelijkheidsleer in 1938.** [Report on the operations conducted on behalf of the Elm Disease Committee at the Laboratory of Genetics in 1938.]—*Tijdschr. PlZiekt.*, xlv, 2, pp. 63–70, 1939.

Details are given of the methods of hybridization practised in the development of elm selections for use in Holland by the Elm Disease Committee [in connexion with their trials for varietal reaction to *Ceratostomella ulmi*: see preceding and next abstracts], and of the cytological characters (chromosome numbers) of a number of *Ulmus* spp. undergoing trials, supplemented by tables showing the pollination, sowing, germination, and production figures of a number of in- and outdoor crosses.

KRIJTHE (N.) & WENT (J[OHANNA] C.). **Inoculaties van Iepenbastarden verricht in 1938.** [Inoculations on Elm hybrids performed in 1938.] —*Tijdschr. PlZiekt.*, xlv, 2, pp. 71–74, 1939.

The results of inoculation experiments in 1938 with the causal organism of the Dutch elm disease [*Ceratostomella ulmi*] on 88 two-year-old hybrids (464 plants) [see preceding abstracts] denoted a clear correlation between growth habit and reaction to the fungus, the percentages of infection for *Ulmus glabra*, *U. foliacea* (large broad-leaved), *U. foliacea*, and *U. foliacea* (small-leaved) being 76·6, 53·7, 63·2, and 42·8, respectively, with a total for the entire number of crosses (including *U. pumila* and others) of 61·8. Besides *U. glabra* and the large-leaved types of *U. foliacea*, the progeny of crosses in which *U. laevis* was used as the female parent were also very susceptible, 14 out of 15 plants contracting infection.

GRANT (T. J.) & SPAULDING (P.). **Avenues of entrance for canker-forming Nectrias of New England hardwoods.**—*Phytopathology*, xxix, 4, pp. 351–358, 1 fig., 1939.

In the course of a study of naturally formed *Nectria* [including *N. coccinea*] cankers on birches, maple, aspen [*Populus tremula*], hickory, and pin cherry [*Prunus pennsylvanica*] in New Hampshire, Vermont, and Connecticut forests [*R.A.M.*, xviii, p. 280], 29 per cent. of the 3,161 examined arose from dead branch stubs measuring from $\frac{1}{8}$ to 1 in. in diameter, 27 per cent. from unmeasured dead branch remnants, 15 per cent. were formed in living branch axils, 8 per cent. were associated with rubbing injuries, and in 21 per cent. the channel of entrance could not be determined. The diameters of 92 per cent. of the 925 dead branch stubs ranged from $\frac{1}{8}$ to $\frac{1}{2}$ in., and those of 95 per cent. of the 470 living branches with axillary cankers from $\frac{1}{2}$ to 3 in.; 25 per cent. of all the measured dead branch stub cankers and 24 per cent. of all the axillary ones fell in the $\frac{1}{2}$ in. diameter classes. Observations

showed that small young branches, buds, and short spurs often serve as avenues of infection, but branches over ½ in. in diameter do not allow entry into the larger branches unless infection occurs at or very close to their axes.

The results of inoculation experiments performed in September, 1935, on red maple [*Acer rubrum*] and yellow birch [*Betula lutea*], in conjunction with field observations, point strongly to the habitual occurrence of infection through living or dying branches rather than through completely dead stubs. Small stems are generally more readily girdled than large ones, while autumn and winter injuries are liable to cause heavier damage than those inflicted in the late spring and early summer, when prompt activity of the cork cambium may serve to arrest the initial spread of the causal organism.

JØRSTAD (I.) & JUUL (J. G.). **Råtesopper på levende nåletraer.** [Rot fungi on living conifers.]—*Medd. Skogforsøksv.* 22 (vi, 3), pp. 300–496, 30 figs., 8 diags., 1938. [English summary.]

This is a comprehensive monographic survey, followed by a 14-page bibliography, of the incidence, host range, taxonomy, economic importance, symptomatology, modes of infection, and control of the following fungi causing decay of living spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*) in Norway, the descriptions of the sporophores and various types of rot being based on a study of indigenous material: *Coniophora* allied to *C. olivacea* (spruce and pine), *Polyporus schweinitzii* (larch, pine, occasionally spruce, oak, and *Prunus avium*), *Polyporus* [*Fomes*] *pinicola* [*R.A.M.*, xviii, p. 361] (spruce and pine), *P. borealis* [loc. cit.] (spruce only), *P.* [*F.*] *pini* [loc. cit.] (pine and spruce, rarely European larch), *P. tomentosus* Fr. var. *circinatus* (Quél.) n. comb. (Syn. *Pelloporus tomentosus* var. *circinatus* Quél.) causing a basal white rot of spruce, and *Stereum sanguinolentum* (brown heart rot of spruce).

ŠKORIĆ (V.). **Žilavka tigrasta—Lentinus tigrinus (Bull.) Fr. Studije o biologiji, razvoju i patološkom djelovanju gljive.** [Tiger 'žilavka'—*Lentinus tigrinus* (Bull.) Fr. Studies on the biology, development, and pathogenic properties of the fungus.]—*Ann. Exp. for., Zagreb, 1938*, 6, pp. 98–126, 5 pl., 6, figs., 4 graphs, 1938. [Received June, 1939.]

*Lentinus tigrinus* [*R.A.M.*, xvi, p. 4] is stated to occur commonly in Yugoslavia on stumps of oak, alder, maple, apple, and willow [*Salix*] trees as well as on living apple and willow, and also on oak railway sleepers. In culture, spores of the fungus began to germinate after 8 hours at 26° to 36° C., the optimum temperature being 32°, and after six days at 4°, but no germination took place at 42·5°. Spores taken from sporophores showed 100 per cent. germination at nine months and 4 per cent. when four years old. The fungus grew poorly at $P_H$ 2·75, best at $P_H$ 3·4 to 3·7, and not at all at $P_H$ 7·05. The minimum, optimum, and maximum temperatures for mycelial growth were below 4°, 32°, and 40° to 42·5°, respectively. The mycelium was killed in 45 minutes at 65°. It is composed of two types of hyphae, one thin-walled, about 3 to 4 $\mu$ thick, with numerous clamp-connexions, forming lemon- or pear-shaped, colourless chlamydospores, 9 to 13 by 7 to 9 $\mu$, and

provided with some characteristic coiled parts. The second type, which develops at a late stage of growth, is profusely branched, thick-walled, 1·3 to 1·8 μ in diameter, and bears no chlamydospores or clamp-connexions. The fungus is homothallic. Successful inoculation of apple trees was only possible through wounds, and in nature the fungus was observed to enter the trees through wounds caused by insects.

ŠKORIĆ (V.). **Jasenov rak i njegov uzročnik.** [The Ash canker disease and its causal organism.]—*Ann. Exp. for., Zagreb, 1938*, 6, pp. 66–97, 6 pls., 5 figs., 1938. [Received June, 1939.]

The bacterial canker of ash is stated to occur in Yugoslavia most commonly along the river Sava and its tributaries. In some cases whole stands are uniformly infected, but more frequently diseased trees are found in groups. Young infected trees become dwarfed and do not attain a height of more than 1 to 2 m. The cankers are mostly of the depressed type, the verrucose form described by Van Vliet [*R.A.M.*, xi, p. 12] being less common. In the early stages they are mostly found near or round the leaf scars, but both primary and secondary cankers occur also in the internodes. Small cankers of the depressed type are formed in one to two years, but large ones (10 to 20 cm. in diameter) take 10 to 30 years to develop. Isolations of the causal organism were inoculated by needle pricks into the bark of *Fraxinus excelsior*, *F. americana alba*, olive, and oleander, but infection resulted in the first-named only. Spraying unwounded ash trees with bacterial suspensions gave no infection.

A comparative study of the ash, olive, and oleander organisms revealed many similarities in their morphological and cultural characters and biochemical activities, but the ability of each to infect only its own host and the differences in the type of reaction produced on the respective hosts is considered to justify the conclusion that the ash organism is a distinct species, identical with *Bacterium savastanoi* var. *fraxini* [ibid., xvi, p. 216] (except that the thermal death point is 48° C. instead of 43° to 46°), and it is accordingly raised to specific rank as *Pseudomonas* (*Bact.* or *Phytomonas*) *fraxini* (Brown) Škor. n. comb. The bacteria were observed to be intercellular (intracellular in damaged cells only). Rain is believed to be the main agent in the spread of the disease, neither wind nor insects playing a significant part. Infected trees should be early removed from ash stands in order to prevent further spread of the disease.

**Legislative and administrative measures.**—*Int. Bull. Pl. Prot.*, xiii, 4, pp. 84 M, 86 M, 1939.

DOMINICAN REPUBLIC. Decree No. 74 of 7th November, 1938, prohibits the importation into the Dominican Republic of living or dead material of *Musa* spp. from Central America, Queensland, Java, Malaya, and Fiji in order to prevent the introduction of *Cercospora musae* [*R.A.M.*, xviii, p. 329], and from Haiti [ibid., xviii, p. 327] with a view to the exclusion of an undetermined banana disease.

KENYA. The Schedule to Government Notice No. 688 of 2nd September, 1937 [ibid., xvii, p. 640] is amended by the addition of barberry and buckthorn (*Rhamnus cathartica*).